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SUPPLEMENT TO THE GEOGRAPHICAL JOURNAL

RECENT GEOGRAPHICAL LITERATURE, MAPS, AND PHOTOGRAPHS ADDED TO THE SOCIETY'S COLLECTIONS. No. 26 AUGUST 1928

These Supplements contain the lists of geographical literature, maps, and photographs which were formerly published monthly in the *Geographical Journal*. The twenty-sixth list, which contains additions to the Library and Map-room received between December 1927 and May 1928, has now been published. These lists can be obtained free of charge by all Fellows on application to the Secretary. The price to Non-Fellows is *1s 6d*

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The
GEOGRAPHICAL JOURNAL

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PRE-GHAL IN WAZIRISTAN: *A paper read at the Meeting of the Society, 4 June 1928, by*

CAPTAIN W. R. HAY

THE North-West Frontier of India is formed by a confused mass of mountainous ranges running roughly south-west and north-east from near Karachi on the sea to Chitral in the extreme north. The Afghan border, which is usually known as the Durand Line, follows a tortuous course through or along or below these ranges. For administrative purposes this mountainous tract, or rather such portion of it as is on the Indian side of the Durand Line, is divided into two Provinces—Baluchistan and the North-west Frontier Province; the latter, with which we are chiefly concerned this evening, being the more northerly of the two.

The North-west Frontier Province consists of five Districts and five Agencies. Reading from north to south the Districts are those of Hazara, Peshawar, Kohat, Bannu and Dera Ismail Khan. The Agencies are Dir Swat and Chitral, which is one unit, and the Khyber adjoining the Peshawar District, the Kurrum adjoining the Kohat District, North Waziristan adjoining the Bannu District, and South Waziristan adjoining the Dera Ismail Khan District.

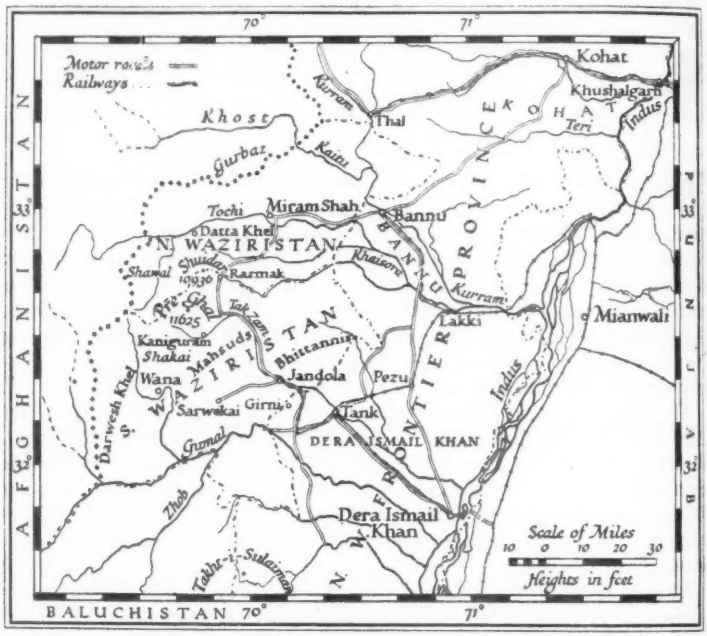
Roughly speaking the Districts comprise the fully administered country in the plains and foothills and the Agencies the unadministered tribal territory in the mountain ranges. There is a fixed line known as the administrative border on the eastern side of which revenue is collected and the law fully administered, and on the western side of which political control of varying intensity is exercised over the tribes.

Waziristan—that is the country comprising the North and South Waziristan Agencies—lies at the southern end of the North-west Frontier Province where it adjoins Baluchistan. It consists of a series of river valleys running from west to east and debouching into the plains, a mass of high mountains in the centre from which the rivers are chiefly fed, and a large plateau in the south. The rivers reading from north to south are the Tochi, the Khaisora, the Shaktu, the Tak Zam and the Gumal. The high mountains consist of a confused mass of ranges with two prominent peaks, Shuidar 10,936 feet and Pre-Ghal 11,556 feet, and the plateau bears the name of Wana.

The greater part of the country is barren in the extreme. In the Tochi

valley and on the Wana plain there are large stretches of fertile land, but otherwise cultivation is almost entirely limited to " Kaches " or the deposits of alluvial soil that collect in the bends and bays of the streams and river-valleys. The natural resources of the country are confined to rope and matting made from the " mazri " or dwarf palm, which grows on the lower hills, and timber and edible pine nuts from the vicinity of Pre-Ghal and Shuidar.

The lower ranges of hills are entirely bare—confused jagged ridges of many-coloured rock. At about 2500 feet the gurgura, a bush bearing an



Waziristan and its approaches

edible berry, the wild olive and other shrubs begin to appear. At about 4000 feet the holly-oak starts and continues up to nearly 8000 feet, getting bigger and thicker as the country rises. Above 8000 feet are fine forests of conifers.

The rainfall averages about 12 inches a year on the foothills and about 50 inches on the higher ranges. This falls half between December 15 and May 15 and half between July 1 and September 15. After good rain the hill-tops and sheltered slopes above 4000 feet often become beautifully green for a short period.

The Waziristan hills form part of what has been called the Sulaiman system, a term which appears to include all the Frontier ranges between the Hindu Kush and the sea. The system takes its name from the Takht-i-Sulaiman, one

of the points of a striking double-peaked mountain which lies just outside Waziristan between the Dera Ismail Khan District and Baluchistan. The Takht-i-Sulaiman, or Throne of Solomon, is so called from a shrine on its summit marking the place where Solomon is supposed to have halted to allow a bride newly brought from India to enjoy a last view of her native land. Pre-Ghal is the highest point in the system south of the Kurran valley with the one exception of Zarghun, near Quetta, which is about 200 feet higher.

Waziristan, as its name implies, is the country of the Wazirs, a large Pathan tribe of probably half a million souls. The Wazirs are divided into two main sections—the Darwesh-Khel or Wazirs proper, and the Mahsuds. The latter, who are about a quarter of the whole tribe, occupy the central and most hilly portion of the country. The Wazirs are all round them on three sides in the Khaisora and Tochi Valleys, in the uplands of Shawal and Shakai, and at Wana; while on the east a small tribe called the Bhittannis intervene between them and the plains. A virile race in a hard and barren country which cannot possibly support them, the Mahsuds have long subsisted at the expense of their neighbours—both by raids, which have often penetrated far into the settled districts of the Frontier Province, and by gradual encroachment of the lands of the less warlike Wazirs and Bhittannis on their borders.

Our relations with the tribes in Waziristan date from the visit of Sir Herbert Edwardes to Bannu and Tank in 1847 and 1848. In 1849, by the annexation of the Punjab we inherited from the Sikhs the onerous responsibility of protecting the settled population of the Bannu and Dera Ismail Khan Districts from their raids. The history of Waziristan in general and the Mahsuds in particular from that time onwards is a series of punitive expeditions culminating in extensive operations in 1919, due to the intolerable state of disorder which followed the Great War and the Third Afghan War.

From 1919, however, a new phase starts. The troops that went into Waziristan stayed there, until early in 1923 Razmak was occupied as a permanent measure and connected by good roads with both Bannu and Tank. Razmak lies beneath the slopes of Shuidar at an altitude of about 6300 feet on the boundary of Wazir and Mahsud country and completely dominates Makin, the home of the Abdullais, the section of the Mahsuds which offered the stoutest resistance during the fighting of 1919 and subsequent years. The effect of the occupation of Razmak and the construction of roads has been magical. The standard of living and general condition of the tribesmen has very much improved, and they have begun to realize that there is much more to be made out of co-operation with Government than by unceasing resistance. Whereas three or four years ago the Mahsud was intensely jealous of the privacy of his mountainous retreats and strongly objected to any attempt to penetrate them, he is now beginning to be quite anxious to show officers round his country and to clamour for roads in the most remote valleys. The motive is almost entirely economic. Raiding being now difficult, if not impossible, the tribesman has to seek other means of livelihood, and of these road-making is one of the most lucrative.

It was this change in spirit that rendered possible the visit to Pre-Ghal I am about to describe. Ever since September 1924, when I took over charge of

the South Waziristan Agency—which comprises the country of the Mahsuds and the Wazir tracts of Wana and Shakai—it had been one of my chief ambitions to climb Pre-Ghal, a point hitherto inaccessible to Europeans, not on account of any difficulties of the terrain but because of the hostile and intractable attitude of the Mashud tribesmen living round it. One Sunday in the hot weather of 1927, while rambling in the hills round Razmak with some Abdullai Maliks and Khassadars, they suggested to me a visit to the mountain. I took them at their word, and towards the end of August summoned some of the leading maliks of Makin and entrusted to them the necessary arrangements.

Before proceeding further it will be convenient to describe the constitution of the Mahsud tribe. The tribe is divided into three main sections —the Shaman Khel, the Bahlolzai, and the Alizai. These sections are again divided into numerous sub-sections. There is no chief or nawab of the Mahsuds as a whole. The big sections have their leading Khans, but their influence is usually only local, and it is with the chiefs or maliks of the sub-sections that Government mainly deals. Each sub-section has a number of maliks of more or less importance, but nearly every adult male has a voice in tribal affairs. The Mahsuds as a whole are extremely democratic. Every man thinks himself as good as his neighbour. The influence of the maliks depends almost entirely on their personality; the tribesmen in general are extremely jealous of them and expect to share in any benefits which Government may confer upon them. It is this spirit that renders the Mahsuds so difficult to deal with. On the visit to Pre-Ghal I was accompanied by nearly three hundred tribesmen, because practically every family in the surrounding villages insisted on being represented. If I had announced my intentions more publicly and given longer notice, it is probable that every Mahsud sub-section would have insisted on sending a contingent—as Pre-Ghal belongs to the Mahsud tribe as a whole—and the numbers would have swelled to over a thousand. As it was our escort was chiefly confined to those sub-sections of the Bahlolazis through whose country we passed, namely the Abdullais, the Band Khels, the Haibat Khels and the Jalal Khels.

Government deals with the Mahsuds through their maliks and tribal jirgas or councils of elders. The maliks are paid allowances and held responsible for the good behaviour of their tribesmen, and every effort is made to uphold their authority. To assist them in their duties tribal levies or Khassadars are appointed from each section and paid a monthly wage. These Khassadars, besides assisting the maliks in the control of their sections, furnish picquets to keep the roads safe and provide escorts for officers touring.

The Mahsud as an individual is an attractive character. The youth is extraordinarily good-looking while the bearded elder is almost always handsome. He is normally cheerful and fond of a joke; he is capable of unlimited endurance, and generally speaking is straightforward and honest. He is not a good liar or flatterer and prefers to call a spade a spade. On the other hand, he is intensely jealous, vindictive and quick-tempered, and becomes a fiend when roused. The blood-feud and the struggle for existence in a land of such poverty lead to constant murders. Except on the Government

Looking over Shawal

Khar Sar and Spinkai Sar from Maisera Sar

Lowarai Punga and Pre-Ghal

Pre-Ghal from head of Sra Tizha Algad

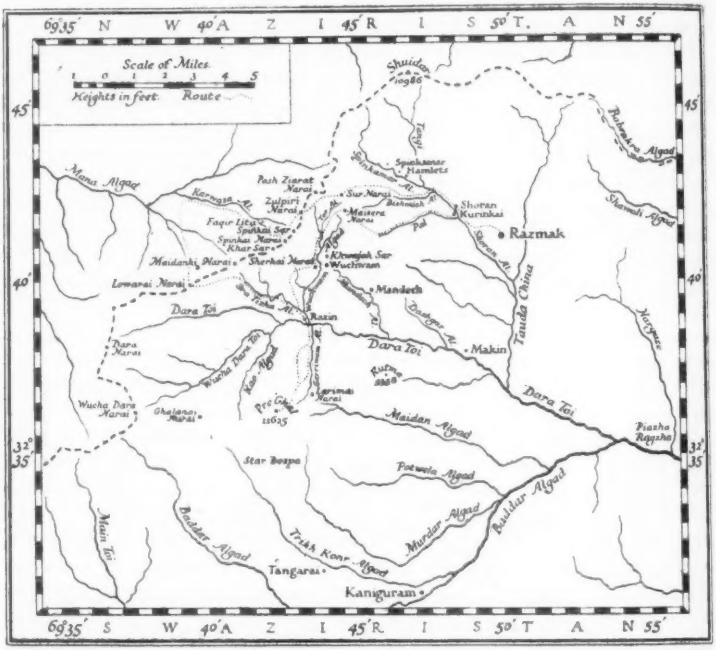
roads, which are more or less sacrosanct, every Mahsud carries a rifle and is constantly on the look-out for a possible enemy.

I arranged to leave Razmak on September 7. Though there were many who would willingly have come, I asked only one British officer to accompany me—Captain R. North, then of the King's Royal Rifles and now of the Indian Army. The success of the expedition was not a certainty, and in the event of any untoward incident occurring a larger number of companions might have proved an embarrassment. Nailo-Tahsildar Maulvi Abdul Manaan, a subordinate Indian official of the Agency, made all the arrangements for rations and transport. We took with us a considerable quantity of flour, rice, ghi, tea, sugar, tinned milk and biscuits for our escort, not to mention some Keating's Powder for ourselves, as Waziristan, though comparatively free from other vermin, is famous for its fleas. These abound in enormous numbers, especially in the spring, when they force the inhabitants to leave the caves in which in the lower altitudes they spend the winter months and live in tents or grass huts which can be moved about. Our camp kit consisted only of light beddings, as it was quite warm enough for us to sleep out if necessary.

We left camp about 7 a.m. and followed up the Shoran Algad to just below the main collection of Abdullai hamlets known as Spinkamar. Here we turned to our left and climbed very gradually up the pebbly bed of the Bishmish Algad. Algad is the local word for the course of a mountain torrent, dry, save for occasional springs, except after rain. We passed on our way the Bishmish village belonging to the Abdullais, a scattered collection of towers and houses amongst terraced maize fields, gay here and there with bright mauve patches of wild sage. Above this hamlet we left the bed of the Algad and climbed steeply up the hill-side, soon leaving the region of scrub oak and emerging on to grassy alps studded with clumps of blue pine and isolated oak trees. Here are the summer grazing grounds of the Spinkamar villagers. The road undulates over the crest of the ridge, and the highest point on it—about 8800 feet—is well to the west very close to the watershed separating the Dara Toi basin from Shawal. The pass by which we crossed over the top of the ridge from the Spinkamar basin into the Dara Toi basin is known as the Sur Narai, or Red Pass. From here we descended slowly down a beautifully green valley beside an intermittent stream, with a forest of spruce and blue pine on one side and on the other grassy slopes starred with gentian and edelweiss. Our direction was roughly south-south-west. After about 2 miles we reached the marshy source of a stream flowing towards Wuchwam village just below a small saddle in the Shawal watershed known as the Pash Ziarat Narai. From this point we climbed to the crest of the watershed and wandering along beautifully wooded slopes—still spruce and blue pine with some fine oaks—at 10.30 a.m. we reached the Zulpiri Narai (8950 feet) where our track crossed a rocky hill-top. Just above this Narai we had a magnificent view of Shawal—the whole of which was spread out like a map before us—a great basin all thickly wooded except for a bare patch in the middle where Wazir towers and cultivation could be seen.

We had with us at this time seventy or eighty maliks, including nearly all

the Abdullai maliks, with a few Band Khels, Haibat Khels, Shingis, Nazar Khels, Bibizais, Guri Khels and one Jalal Khel, Balikai, who was to be our host for the night. They had intended to take us by a direct route past Wuchwam to Razin in the Dara Toi, but when we reached the top of the Sur Narai, suggested going *viâ* the Lowarai Punga instead. I gladly accepted, knowing that we should see more of the country. The object of this manœuvre became clear when we arrived at the Zulpiri Narai and the maliks began to describe the points which they alleged marked the boundary between Mahsud and Wazir country. This boundary included a large portion of the southern rim of the Shawal basin. I promised the maliks to put on record



Capt. Hay's routes north of Pre-Ghal based on the Survey of India, with names added by the author

the names they had quoted without committing myself to any expression of opinion.

I would note here that there is bitter hostility between the Wazirs and Mahsuds on the subject of their boundaries, especially in the vicinity of Razmak, and there has been serious fighting between them on the subject. I have remarked before that the Mahsuds are always encroaching, and it is extremely difficult to lay down where the *de facto* boundary is at any given time. Each side claims much land to which it certainly has no title of any kind, but in between there is always a pretty big strip to the ownership of which both parties can put up a very specious case. In the present instance

the real boundary probably runs along the watershed, the whole of Shawal being Wazir and the Dara Toi basin Mahsud.

Shortly after leaving the Zulpiri Narai we descended sharply down the Shawal side of the watershed to the bottom of a narrow ravine leading down from the Spinkai Narai, which lies between Spinkai Sar—a hill surmounted by a sheer white cliff facing south-east and a regular landmark as seen from Mahsud country—and Khar Sar, a conical well-wooded height of a dull-brown colour. The track leading over the pass appears to be of little importance. It is at about this point that the nature of the forest entirely changes; from here onwards for miles there are deodars, mostly of a small variety, and practically nothing else except occasionally a few blue pines. I noticed a great many young trees growing up.

Before descending from the watershed we passed a resin-pit where the deodar wood is burnt and the resin allowed to run out into a small basin. It is used medicinally for sheep, camels, etc., as a cure for skin diseases. The local word for it is " Ranzara "; it sells at about a rupee a seer (2 lbs.).

We now descended the ravine, which soon widened into a small valley, for several miles in a west-south-westerly direction. At about 8100 feet we came to a spring just below a camping site called Faqir Lita. The spring and the valley are known as Karwaza. From here we followed a marshy stream thick with flowers between alternate forests, and grey fantastic cliffs with toy deodars growing out of their clefts and crannies. Farther down we passed a number of terraced fields which the Mahsuds claimed as theirs. Apparently they were made by Marwats, but since that tribe left the country, probably two centuries ago, they have not been cultivated except very occasionally by a Mahsud or Wazir whom necessity has compelled at the risk of his life to endeavour to raise a small crop on them.

From the Sur Narai to the Lowarai Punga not a sheep or goat was seen, although grazing was abundant. I am told that in the spring Mahsud or Wazir flocks do occasionally graze here surrounded by an armed guard with their rifles held ready to fire. Apart from our own party not a single human being was seen, except three grey-bearded unarmed Wazirs, who were crossing the Lowarai Punga to visit some Mahsud friends.

We must have gone some 3 or 4 miles down the valley, which descended very gradually. At a point at which the aneroid read 7850 feet we turned due south, and a short ascent brought us on to a broad undulating plateau covered with deodars. Other trees were entirely absent. There were many open places carpeted with brown grass and withered gentian plants, this portion of the country having obviously had much less rain than the vicinity of the Sur Narai. We found only one small spring. We passed a fairly large cemetery at which all our escort stopped and prayed, and a camping site which did not appear to have been recently used.

An hour's walk brought us to the Lowarai Punga, a huge clearing some 3 square miles in extent, which appeared at some very ancient date to have been terraced for cultivation. It was covered with beautiful turf somewhat greener than the country through which we had just been passing. It slopes up gradually from south to north to an altitude of about 8000 feet, and the country then falls away steep and well-wooded to the Shawal basin. At the

top of the Punga is the tomb of Bahlol, eponymous ancestor of the Bahlolzai section of the Mahsuds. The tomb lies close beside a deodar, and consists only of a rough heap of stones surmounted by a number of long poles bearing small white flags and enclosed by a low wall of loose stones. The main route from the Dara country to Shawal crosses the watershed close by. We halted near the shrine for an hour and a quarter, and it was only here that there appeared to be any likelihood of trouble occurring.

We had had a few alarms and excursions before. When we turned up the Bishmish Algad below Spinkamar a man was seen running excitedly towards us. He announced that the Turan Khels of Mandech had collected a lashkar or tribal gathering to block our way. We went on unconcernedly and very shortly met the leading Turan Khel Malik Kal Khan, who said that with great difficulty he had persuaded the lashkar to assist our passage instead of opposing it. A letter was also received from the Shamak Khels of Dara saying they would not allow us to visit their country, but of this, on the advice of the maliks with us, no notice was taken. It should be explained that these threats did not really denote any hostile intention. All the persons concerned wished to signify was that the expedition could not take place without their good-will, and that they expected a share in any of the rewards which might be given as a result of it. On the top of the Sur Narai a Bibizai rudely assaulted one of our sowars, claiming his pony. A few minutes' uproar arose until the Bibizai was almost literally sat on by the rest of our party. At the Spinkai Narai a shot was heard close at hand, and everybody stopped for a minute. We were relieved to learn that the bullet had found its billet in a pig.

The trouble on the Lowarai Punga was of a different kind. The trip had been arranged principally by the Abdullais of Makin ; our route lay largely through Nano Khel country. The Nano Khels—Haibat Khels with a few Umar Khels and Malik Balikai Jalal Khel—insisted that they and they alone should have the honour (with benefits to follow) of taking us up Pre-Ghal. This the Abdullai Maliks with Aziz Khan Shingi and Haiyat Khan Nazar Khel, who were mainly responsible for our safety, could not allow. A frightful din arose. With some difficulty I managed to persuade the disputants to go and shout at each other at some distance away, and we ate our lunch in peace. The Aimal Khel Maliks (Abdullais and Nazar Khels) then came and assured us that nothing on earth would make them abandon the trip. It had become a point of honour, and if necessary they would take us round by another route through their own country. Eventually the whole matter was settled amicably and all concerned made a self-denying ordinance not to mention the word " bărid " (boundary), *i.e.* not to assert a claim of ownership to any of the country through which we might pass.

The question of boundaries between the various sections is a very delicate one and not to be broached lightly in Mahsud country. Except in the case of villages or cultivation it is never safe to ask to what section any piece of ground belongs. The fact is that the boundaries in uninhabited country are not really properly defined ; everybody thinks you have come to select a site for bungalows or a line for a road and is anxious to establish his claim to compensation at the earliest possible date. This leads to violent altercations and has been known to cause really serious trouble.

After leaving the Lowarai Punga we hardly heard a high word during the rest of the trip. We turned back at an acute angle from the route by which we had come and for two miles ascended in a north-easterly direction by a well-defined track over the same undulating deodar country. We then descended sharply down a nala bed. This route is known as the Sra Tizha route from a remarkable dome of red rock which is passed on the way. At about 7800 feet conifers ceased to predominate and the familiar oak scrub reappeared with an occasional edible pine or deodar. The descent was easy. About half-way down we made a long halt for prayers by a small spring. The nala soon changes to a broad Algad, called the Sra Tizha Algad. Shortly before it reaches the Dara Toi it is joined by the Wuchwam Algad, and at the point of junction there is cultivation and a tower belonging to Malik Bagh Gul Umar Khel. Here we left the Algad and climbing up a slope on the right bank crossed a ridge and descended to the village of Razin, where we were to spend the night. The distance traversed during the day was about 24 miles.

Razin is a village of some thirty families of Toji Khel Jalal Khels. The leading man is a minor malik called Balikai—a good fellow with a great sense of humour and a loud voice. The main village, which consists of a number of mud houses with a tower or two, is on the left bank of the Dara Toi with a fairly wide stretch of maize fields lying between it and the stream. I made its altitude about 7100 feet. The stream contains plentiful water. On the opposite bank are a number of sheds to which the people of the village retire in the hot weather, presumably to escape the fleas which have accumulated in their proper houses. The most remarkable feature of the Dara Valley at this point is the cliffs of snow-white rock which overlook it. On one of them, facing Razin, is a black streak like a huge snake with its head downwards as though it was descending towards the village. There is some old legend connected with this.

Balikai had sent his women and children to one of the sheds on the opposite bank and placed his house at our disposal. A room had been made ready for us in his tower, but as it was very small and had to be reached by a perfectly atrocious type of ladder, we preferred to take up our quarters in the house proper below the tower. This was full of an extraordinary assortment of bags, skins and other receptacles hanging from the roof or reposing in corners, and was by no means void of fleas; but it was entirely open on the side towards the Toi, so we had plenty of fresh air and a lovely view of Pre-Ghal towering up immediately above us, while later on we were able to watch the whole process of the cooking of a Mahsud meal.

Our party by the time it reached Razin numbered about two hundred, many Khassadars and others who had been out picqueting having joined us. We found tea ready, and having refreshed ourselves proceeded to settle down in our quarters. A succession of sheep and goats now began to arrive, escorted by local Maliks and "mutabars"—this being a common form of hospitality and a sign of respect. These were all accepted and, with the rations we had brought ourselves, were distributed amongst our lashkar.

Our host produced a huge goat which he wished to slaughter and put into the pot in our presence. We, however, insisted on its being slaughtered

outside. A large fire was now lit and on it were placed two huge earthenware vessels (Katau) full of water, two iron degchies (Deg), and a huge iron grilling utensil (Katorai). The ribs (Pashtai) of the goat were threaded on two sticks and stuck into the ground by the fire to roast. Pieces of liver and other dainty portions (Larmun) were dealt with by means of the grilling instrument. The rest of the meat was cut up and boiled in the earthenware pots, while the degchies were reserved for rice.

Our host, with his relations and friends, sat round the fire and did not finish their meal till nearly midnight. Ere this we had satisfied ourselves and retired to bed and such sleep as the fleas would allow us. A curious thing we found about the fleas was that though their passage over our bodies caused great annoyance their bites were practically innocuous.

A party had been sent out the previous night to occupy the summit of Pre-Ghal early in the morning and prevent any possible enemy reaching it before us. We ourselves set out at 6.20 a.m. and descending to the Toi, or stream, followed it down for a short way and then turned to our right up the Garriwam Algad. Conifers were plentiful at about 7600 feet, consisting at this point of spruce and blue pine. We did not see a single deodar on Pre-Ghal. Silver fir is abundant towards the top.

The Algad gradually became narrower and the sides more precipitous. We passed a huge fallen tree blazing hard ; our advance party had set it on fire to keep themselves warm during the night. Some 4 miles up the Algad at an altitude of about 8475 feet we came to plentiful water. Here we turned off up a side nala and were soon climbing up a very steep slope covered with grass and flowers and flanked on either side by sheer grey cliffs. A long and stiff pull, sometimes up grassy slopes sometimes over rocky outcrops, brought us to the crest of one of the main spurs of the mountain at about 9825 feet. From here we went straight up the spur with much clambering over rocks : it was hard work but the going was nowhere really difficult or dangerous. We reached the top at 10.5 a.m., three and three-quarter hours after leaving Razin ; the aneroid read 11,625 feet, showing little difference from the height recorded on the map, viz. 11,556 feet.

On the very summit is the shrine of Pre-Ghal—a grave enclosed by a rough wall of stones with the usual tall poles surmounted by little white flags; attached to the shrine is a small square building for the shelter of pilgrims.

The mountain is often incorrectly called Pir Gul or Pir Ghal. The correct name is Pre-Ghal. The Mahsuds say this name has nothing to do with the word " Ghal," meaning in Pashtu a thief. Pre-Ghal is a term denoting a very holy man, and they say that the tomb is that of a saintly Faqir who in very ancient times led a hermit's life in the forests of the mountain. An isolated height like this must have been a holy place from time immemorial, and it is possible that the real meaning of its name should be sought in the language of some people who possessed the country before the Pathan invasion. The Hindus have legends about the mountain which they say is sacred to Shiva.

There is no custodian of the shrine, which is chiefly frequented by sonless men and barren women, as prayers offered there are said to be efficacious for the production of offspring, especially male offspring.

The top of the mountain consists of three points. The most easterly, which is the highest, is treeless and covered with a squat and very thorny shrub like gorse; the central one, which is the lowest, is well wooded on its northern side; the most westerly one is bare like the highest point, and is known as Kam or lesser Pre-Ghal. Except for the summit and a few precipitous faces the whole mountain is well wooded, but on the upper slopes about two trees out of three are dead skeletons, and many of them by the force of wind or snow have been knocked sprawling down the slopes. This is everywhere noticeable where the forests consist of spruce and silver fir, and is due to the fires which resulted from the long drought of 1920–21. The deodar forests do not seem to have been affected. Besides the conifers there are some fine oaks on the mountain and also in places thick jungles of wild cherry.

The flora of the mountain appears to be very similar to that of the lower Himalayas, except that some of the varieties are smaller and paler. Some specimens were collected and sent to Mr. Ronald Good, of the British Museum, who has kindly identified them.

There were various herbs, which the tribesmen sought for eagerly. One was a flower like a small "everlasting" with a very sweet smell, called *Kasturai*. They collected large bunches of this, to be taken home to their families and used like lavender to perfume clothes or decorate the house. Another is called *Karaska*. It looks and smells like celery, and has a long tapering root containing a sort of white pith which is used as a flavouring for tea, and is also said to be an antidote for indigestion. Another has a heart-shaped leaf like a violet, and is called *Mirsalai;* its root is very sweet-smelling. Bits of it are dried and threaded as necklaces for small girls. A fourth is called *Miralam*. It is a tall reed-like plant with a long white root containing glutinous substance; this is eaten by mothers to improve the supply of milk. Another, which is a sort of small yellow vetch, is called *Momirai;* the stalk of it rubbed on the eye produces much inflammation but improves the sight.

Bears are said to be plentiful, and panthers are also found. Owing to our enormous escort it was very improbable that we should see any game, but a party who came up to meet us from Badar on the south side of Pre-Ghal had shot a female "Markhor," a kind of wild goat, on the way. Oorial, or wild sheep, are said to be abundant. Bird life was remarkable by its absence, and practically no butterflies were seen; but there was no lack of other insects, such as bumble-bees, wasps, flies, etc.

Of the geological composition of the mountain I am not competent to write. The cliffs were mostly of a uniform dull grey colour, and in the nala bottoms were many lumps of speckled rock, with the appearance of granite. The higher strata of rock were certainly igneous.

The view from the top was superb, and must be unspeakably magnificent on a clear day in the cold weather, when it is said the Indus can be seen. As it was the plains and Wana were obscured by haze, above which only the topmost peak of the Takht-i-Sulaiman appeared like some strange aerial islet. The range of the Safed Kok was hardly visible, but otherwise the country was spread out like a map, from the confines of Baluchistan to the Kurram, and

from Girni and Gabar to the hills of Gardez and Khost. The whole of the Dara Valley and Shawal were displayed in detail; the road could be seen winding up the upper half of the Razmak plateau; Piazha was visible, and the green maize fields of Maidan and the Badinzai Tangi could almost be counted. Kaniguram was hidden behind a ridge, but the whole of Badar with the Tangarai and Mishti Valleys laid bare its innermost secrets; beyond it Shakai stretched broad and yellow, and the Khaisora villages tried in vain to conceal themselves behind a curtain of haze. The Kotkum hills and Bobai stood sentinels over an invisible Wana. Westwards were great forest-clad slopes, backed by a series of long ridges stretching far into Afghanistan.

Immediately to the south of the summit and about 2000 feet below it is a beautifully green plateau known as Bospa. This, according to the Mahsuds who accompanied us, is the highest point on the mountain which any European has previously been allowed to reach, and that many years ago. The tribe regard the mountain as their "Takht" or throne, the sanctum of their country and the symbol of their inviolable independence. Their voluntary disclosure of its mysteries is a notable sign of their changed attitude towards the British Government.

Many tribesmen were on the summit when we arrived, including a party of Malikshahis from Badar, who had spent the night there. For some months they had been adopting a threatening attitude over certain grievances, but they now presented an enormous goat and asked in a reasonable manner for redress. Naib Tahsildar Abdul Manaan, who very bravely undertook a climb for which he was fitted by neither build nor habit, reached the summit some time after us, and when we were all collected our party must have numbered between two and three hundred persons. A thorough picnic spirit prevailed, many of the Mahsuds with us never having climbed the mountain before.

We spent some two hours on the top and began our descent from the western extremity of Kam Pre-Ghal. From here the position of the Ghalanai and Bosh Narais could be seen, and also the actual track of the Machi Narai. Descending in a southerly direction we reached a small saddle connecting the central mass of the mountain with a subordinate ridge. Here we turned due east down a fairly open valley, which fell steeply away beneath the southern face of the mountain-top. Flanked by battalions of silver fir we waded waist-deep through a sea of flowers with occasional snags in the shape of stinging nettles. A thousand feet from the top we struck a plentiful spring of very cold water, and for the next 2 or 3 miles we walked beside a babbling stream with a disconcerting way of disappearing and coming up again. It was some time before we realized we were in the Garriwam nala by which we had begun our ascent in the morning; it starts at the western extremity of the mountain-top, runs all round the south and eastern sides of it, and finally flows into the Dara Toi on the north. When we had descended some 2000 feet the Badinzai Maliks from Tangi, who had joined us the previous evening, left us and climbed up to a small saddle on the spur a few hundred feet above us, which they called Larimai Sar. They were on their way to Larimai village, which lies at the head of the Maidan Algad.

Hitherto the valley had been fairly open and running in an easterly direction; it now turned northwards and dropping by a narrow defile

Razin village and Pre-Ghal

The Dara Toi valley at Razin

On the ascent of Pre-Ghal

In the Garriwam Algad

through a feature of solid rock emerged into the lower and darker slopes of the mountain. In the defile were a series of "Zowas" or sheer drops over closely-wedged irregular rocks, and the going was somewhat difficult. When the valley broadened out again it was full of rocks and boulders instead of grass and flowers, and the whole height of the slopes on either side was covered by thick forest.

It was here we passed the "Sarwai Gola" or "Tunnel Rock," a natural curiosity which, like some logan-stone in England, impressed the people much more than the scenic magnificence of the country. A torrent rushing down the mountain-side has encountered a rocky outcrop, and instead of cleaving it with a gorge has only pierced its lower portion, leaving a natural arch of stone. The tribesmen relate that this was a miracle performed by some holy man, possibly old Pre-Ghal himself, with a push of the hand, and treat the place with superstitious reverence, making little heaps of stones on the rocks in the valley below.

At 3.15 p.m. we reached the spot in the valley where we had turned off in the morning, and we arrived back in our quarters at Razin at 4.30 p.m. without further incident. After getting in I was pestered with a series of alternate deputations from the Nano Khels and Aimal Khels regarding the route to be followed on the return journey the next day. We had been brought to Razin by the Aimal Khel Abdullais and had caused a certain amount of inconvenience to the local Nano Khels. The Nano Khels now wished us to return the next day *viâ* Makin, in order that they might get their return in kind for the maize-cobs looted from their crops in the Dara Toi. The Abdullais had previously suggested taking us through Makin secretly by night when their women and children would not be on view; to this I objected that they had brought us to the Nano Khel villages by day and that it was only fair on the Nano Khels to take us through their own village by day. Finally they acknowledged that lower down in the valley there was a settlement of Hindustani Fanatics through which we would have to pass, and that their leading Mulla Shahbadan had begged them not to bring us that way and that this was their reason for avoiding the Makin route. Eventually it was amicably decided that we should return on the morrow *viâ* Wuchwam and the Sur Narai.

On September 9 we left Razin at 6.15 a.m. by the road by which we had come. A few hundred yards above the Wuchwam Khula we turned to our right up an opening called the Dalali Khula and struck a good track running up the hill-sides in a north-easterly direction and known as the Khanna Punga road. The ascent was very gradual, sometimes winding in and out of spurs and sometimes passing up nalas lined with thick oak forest. The holly-oaks here attain a great size—their trunks being often 10 feet or more in girth. Conifers there were none, except an occasional deodar. Great precipitous citadels of dark-grey rock were a feature of the country—one of them was said to have been chosen by wild bees as an impregnable store-house for their honey.

Passing the Khanna Punga somewhere on our left, after 5 miles we reached the Sherkai Narai at an altitude of about 8600 feet. Here the track crosses a subordinate ridge and drops by a steep but short descent to Wuchwam,

a straggling village of some thirty or forty mud houses and a few towers, lying amongst maize fields at the foot of a fantastically shaped eminence known as Khwajak Sar. Leaving the main village on our right we turned up the stream which waters it and made our way between maize crops with dwellings here and there, till we reached the junction of two streams—one the Sperka Algad, flowing down from Pash Ziarat, and the other, that on our right, the Tor Algad, which comes from the Sur Narai. We followed the latter, but soon left it, taking a steep and direct route to the top of Maisara Sar (9332 feet according to the map), from which we were able to survey the line of our travels during the last three days. The sowars and camels followed an easy path to the Sur Narai *viâ* the Tor Algad.

Razmak was now in sight and our expedition was drawing to its close. Proceeding down the ridge in a south-easterly direction we crossed a narrow saddle, from which the fields of Mandech were just visible, and then descended by the Pal towards the Shoran, which we joined just below the ruins of Kurinkai. The going during the descent was easy, and most of our path lay through thick oak scrub. We reached the camp at 11.30 a.m., and nothing remained except to reward those who had assisted us—a proceeding which occupied most of the afternoon.

Much of the country over which we passed probably had never before been trodden by a European. The nearest approach appears to have been during the third Mahsud expedition in 1894, when Mandech, Razin and the Bospa plateau were visited.

A great feature of the trip was the good temper of the Mahsuds with us and their eagerness to show us all the sights. On the way some of them inquired whether we had come to make a map or to find a site for a summer station, but it was not till a few days after our return that I learnt what many of the tribesmen thought was the real reason of the expedition. I was holding a jirga with the same Malikshahis who had met us on the top of the mountain. There was present amongst them the father of two boys who had been more or less accidentally killed a few months previously in a small skirmish in which some irregular forces of the Government had been concerned, and they were asking for compensation for their death. "Of course," they said, "having no sons you do not know what a father feels," and then added, smiling, "But we all know why you went up Pre-Ghal."

The following plants have been identified by Mr. Good and Mr. Norman:

Ranunculaceæ—
Thalictrum pauciflorum Royle
Aquilegia viscosa Gouan
Clematis sp.
Cimicifuga sp.
Caryophyllaceæ—
Melandrium cabulicum Boiss.
Dianthus crinitus Smith
Geraniaceæ—
Geranium aconitifolium L'Herit.
Impatiens sp.
Leguminosæ—
Medicago sativa L.
Rosaceæ—
Prunus Padus L.
Saxifragaceæ—
Parnassia nubicola Wall.
Crassulaceæ—
Sedum Ewersii Ledeb.
Onagraceæ—
Epilobium angustifolium L.
Epilobium minutiflorum Haussk.

Umbelliferæ—
Bupleurum falcatum L.
Vicatia coniifolium DC.
Two incomplete specimens.
Dipsaceæ—
Dipsacus inermis Wall.
Compositæ—
Conyza japonica Less.
Prenanthes Brunoniana Wall.
Lactuca hastata DC.
Anaphalis Royleana DC.
Cirsium arvense Scop. ?
Ligularia sp.
Gentianaceæ—
Gentiana nubigena Edgw.
Swertia cordata Wall.
Scrophulariaceæ—
Leptorhabdos Benthamiana Walp.
Euphrasia officinalis L.
Labiatæ—
Nepeta spicata Benth.
Leonurus sibiricus L.
Chenopodiaceæ—
Chenopodium Botrys L.
Thymeleaceæ—
Daphne oleoides L.
Euphorbiaceæ—
Euphorbia pilosa L.
Urticaceæ—
Urtica dioica L.
Cupuliferæ—
Quercus dilatata Lindl.
Quercus Ilex L.
Quercus semicarpifolia Smith.
Liliaceæ—
Allium rubellum Boiss.

Local Pashtu names of different kinds of trees are : Deodar : Almanza ; Blue pine : Nashtar ; Edible pine : Zanghozai ; Spruce : Sirup ; Silver fir : Sra Sirupa ; Wild cherry : Karlawa ; Walnut : Watak ; Willow : Wila. A large oak found at high altitudes : Qalandar Tsirai ; the Common Holly-oak : Sperka Tsirai ; a Holly-oak with larger leaves than the common one : Ghwara Tsirai.

The following is a glossary of Pashtu geographical terms used in the paper :

Algad	Torrent bed.
Kamar	Cliff.
Khar	Mud-coloured.
Khula	Mouth (of stream or torrent bed).
Lita	Earth (*i.e.* soil).
Narai	Saddle or pass.
Punga	Open level grazing-ground on top of ridge or hill.
Sar	Head or peak.
Spin	White.
Sur(m) Sra(f)	Red.
Tangi	Defile.
Tizha	Rock.
Toi	Running stream.
Wam	Field.
Ziarat	Shrine.
Zowa	Steep fall in a defile.

DISCUSSION

Before the paper the PRESIDENT (Col. Sir CHARLES CLOSE) said: Captain Hay, who is to address us this evening, was in charge for three or four years of the South Waziristan Agency, a region to the west of Dera Ismail Khan on the North-West Frontier of India. Whilst there he had the opportunity—or rather, made it—of visiting the Mahsud country, and in the course of his journeys he visited many places which have not previously been seen by a European, and had the great luck to be able to climb the mountain of Pre-Ghal the highest

peak in that neighbourhood, being between 11,000 and 12,000 feet. Captain Hay is one of the first Europeans to have climbed that mountain, and he was accompanied by Major R. North and by several hundred natives. I ask him now to give his lecture.

Captain Hay then read the paper printed above, and a discussion followed.

Major-General LE GRAND JACOB: I must congratulate Captain Hay, who has given us a very interesting lecture, not so much for the actual feat of climbing Pre-Ghal, which after all is not a great mountaineering feat, but on the political state of the country which enabled him to do it. That is the most important part of his lecture. I had a good deal of experience of Waziristan during my eight years' service there at different times. It is about thirty years since I first came into contact with that country. I left it about eighteen months ago when I was commanding in the Waziristan district. Ever since we annexed the Punjab and first come into contact with the Wazirs and Mahsuds there had been a succession of punitive expeditions which go into the country and do a lot of damage and clear out. The effect of that was very small. It cannot be permanent. After a few years the people forget and start raiding again. Since 1919, instead of leaving the country after such an expedition, we have remained.

I was commanding the Field Force which occupied Razmak in 1923, and the effect of our occupation is extraordinary. It has completely changed the whole situation, as also has our policy of constructing good metalled roads, fit for motor transport, all through the country. This policy was advocated years ago, but was never carried out until now.

As some indication of the change, I remember when I was first up in those parts I was one of the officers told off to raise one of the frontier regiments now called the South Waziristan Scouts, with headquarters at Wana. The price of a Mahsud in those days was 600 rupees; now, as the lecturer has said, it is about 3000 rupees. The value of everything has gone up tremendously. The making of good roads and communications through the country has increased the standard of living. I do not know whether any of those present have read a novel which came out about fifteen years ago under the title of 'The New Road,' by Neil Munro. It deals with the road which General Wade drove through the Highlands about 1750, which had the effect of taming the Highlanders. That is exactly what we are doing in Waziristan—and incidentally putting a lot of money into the pockets of the Mahsuds.

I was talking to an old friend of mine, an ex-Mahsud officer who used to be in my regiment, and asking him about his pension. He told me that it was about 75 rupees a month. I said, "You must be very comfortably off." "No, not so well off as you think. Things are quite different from what they used to be. When you first came up into these parts the Mahsud was content to eat bread made from Indian corn, and you know what his clothes were—not much. And as for tea, well, he did not even get a sniff of it. Further, if he wanted to go down into Tank it took him three or four days on his flat feet. Now the Mahsuds drink tea and won't look at Indian corn bread unless obliged to. They like the best white flour which they get from Tank. And look at their clothes, very different from what they used to be. And when they come into Tank to see relations or shop in the bazaar they do not come on their flat feet; they get into a motor. That all costs money." That gives you an idea of how the standard of living has gone up. There is no doubt that in providing communication and making good roads you raise the wants of the natives, civilize them, and bring money into the country.

As the lecturer remarked, things are so quiet now that you will not see any

Mahsuds going about with rifles, and I am convinced that in five or ten years' time you will find the country will disarm itself if we continue the present policy, as I hope we shall. The next step—and we are commencing now—is to continue the road from Sarwakai to Wana and occupy the latter place with Regulars, connecting up Wana with Razmak. Then you will have the country in your hands. It is a most beautiful country. I took Lord Kitchener through there for the first time up from Wana, and next time I went through a year or two later with Sir John Donald from the opposite side.

Captain Hay mentioned the trouble with fleas, and so on. Well, the Mahsuds are not very clean, and always sleep without any clothes on on account of the vermin. I remember in an irregular corps which had a number of Mahsuds in it, we had one night a practice alarm to see how quickly they could turn out. We noticed that the Mahsuds were a very long time, and found the reason was that they were all hunting for their clothes in the dark !

Brigadier WILSON-JOHNSTON: I would like to thank the Royal Geographical Society for giving me this opportunity of being present to hear my friend Captain Hay recount his deeds and misdeeds. The President told us that Captain Hay had been in charge of the Mahsud territory for some three or four years, and there is no doubt that the rapidity with which the people are settling down and accepting British rule is due in no small measure to the tact and ability of Captain Hay. He is typical of the political officer on the North-West Frontier of India. Whenever there is trouble it is the Political Officer who pushes out to see what it is all about, and if there is no trouble, off he goes to Pre-Ghal or elsewhere to see whether there is any coming.

I think you will agree that Captain Hay's expedition to Pre-Ghal proves entirely to our satisfaction the soundness of the methods we have adopted on this part of the North-West Frontier of India.

Mr. RONALD GOOD (Natural History Museum): The small collection of plants which Captain Hay was able to make and send home during his trip proved of very considerable interest, not only because it came from a region very poorly represented in the collections in this country, but also because the region is very interesting from the point of view of plant geography.

A considerable distance to the north-east of Pre-Ghal, where the Indus comes out of the main Himalaya mountains, three of the most important floral zones of the Northern Hemisphere meet. The main Himalayan chain and the line joining its western extremity to the Caspian forms the southern limit of what is called the Central Asiatic flora. A line drawn from Kashmir almost due south to Baroda forms the line of junction between the Mediterranean–Oriental region on the west and the Indo–Malayan region on the east. That is, of course, a very broad view; and all these regions can be divided and subdivided, with the result that within a comparatively few hundred miles of Pre-Ghal quite a number of different floras are represented, and it becomes interesting to see how far these various floras are represented on Pre-Ghal itself.

Although the mountain lies actually within the Mediterranean–Oriental region its elevation means, of course, that it bears some sort of vegetation different to the general vegetation at its base, and one would expect that vegetation to be largely or entirely Himalayan. Of the thirty-two species which Captain Hay collected, about half a dozen belong to floras so widely distributed in the Northern Hemisphere that their occurrence on Pre-Ghal is not significant; that is to say, one would expect to get them anywhere within northern temperate regions or at high altitudes farther south. But of the remainder, about five wete definitely western species, and the rest all Himalayan. Of these five western species no less than four occur on the Himalayas. The one species that does

not occur there is an Afghan endemic species, so that the flora of Pre-Ghal is almost entirely Himalayan.

I endeavoured, by worrying geological friends, to ascertain their opinion as to the time Pre-Ghal was uplifted, but without much success. Apparently, one is justified in thinking that its uplift dates subsequently, or at any rate not prior, to the main uplift of the Himalayan chain, and that main uplift appears to have begun in the eastern end and travelled towards the western end. Thus perhaps Pre-Ghal became a mountain after the main bulk of the Himalayan mountains, and that, of course, is important from the botanical point of view because, as is now well known, the Western Chinese mountains support what is the richest Alpine and temperate flora in the world, and I think there is very little doubt that the Himalayan flora, which is also very rich, has largely originated from the Western Chinese mountains. The Himalayan mountains were uplifted subsequently to these latter and formed new country along which the Chinese plants migrated, and it appears that Pre-Ghal in turn received its flora from the Western Himalayas.

Lord RONALDSHAY: It is a good many years since I was in Mahsud country, in fact, it was in 1900 that I travelled from Dera Ismail Khan up to Tank and thence up the Gumal river to Kajuri Katch and to a little outpost known as Kashmir Kar. In those days the country between our administrative frontier and the Afghan border was indeed a veritable Alsatia, where every man did that which was right in his own eyes. I was anxious to study the zoology of the neighbourhood and to shoot a straight-horned markhor. The little escort of Border Police which insisted upon accompanying me when I went up into the mountains from Kashmir Kar took a great interest in the game up to a point; that is to say, they looked anxiously for tracks of bear or markhor, but their interest in the game suddenly vanished. When I inquired why, I discovered it was because they had found the track not of a markhor or a bear but of a Mahsud! They hurried me incontinently back into the safety of Kashmir Kar fort. As a matter of fact, I did get a shot at a bear on the way, though not a successful one.

The Petty Officer in command of the outpost had apparently received instructions from the nearest British authority to send in a report upon my visit. I heard him in the evening in animated conversation with my English-speaking bearer and inquired what he was talking about. It appeared that he was consulting my bearer as to what he should put in his report, and asking that my bearer, in his turn, should consult me. Well, I asked him what he proposed to put in the report, and the latter, as he had prepared it, read as follows: "The Sahib went out after shikar. The Sahib had a shot at a bear and the Sahib missed the bear." I said there was no necessity to lay too much stress on the last part of the report! I have no doubt that that report is still to be found on the files of some frontier outpost.

What I admired most in Captain Hay's lecture was the success with which he skated over the very thin ice of politics. I am not quite sure that General Jacob was so successful. It seemed to me now and then that his skates were in danger of going through the ice. But, after all, that is not surprising, for there is no part of the world in which geography and politics are so inextricably interwoven as they are on the North-West Frontier of India, and for the reasons which Captain Hay in his lecture indicated, though he did not lay undue stress upon them. I think I can indicate them in a sentence. A man who knew China very well once said that the problem of China was the filling of three bellies with one bowlful of rice. The problem of the North-West Frontier is very similar. It is the problem of filling three bellies with one bowlful of maize or wheat; in other

Upper Dara Toi from the east

Phot. C. H Stockley

Razmak plateau from the north

Phot. C. H. Stockley

words, the problem is an economic one. The country is not capable of sustaining more than a very small population, and when the population increases beyond that limit what do the people do? Naturally they raid down into the plains and seize the food which they are not able to provide in their own country. How is that state of affairs to be brought to an end? Obviously—I am afraid my skates may go through the ice for a moment—in the way in which General Jacob suggested: by bringing money into the country which will enable the people to buy the food which they cannot themselves produce. Money can be brought into the country by the building of roads and other such measures. I have not the smallest doubt in my own mind that the change which has been brought about in the conditions of Waziristan since I visited the country in 1900 is, in the main, due to the fact that since the British have been in occupation of part of the Wazir country, they have provided remunerative employment for the people. Not only has the result of that been to raise the standard of living, as General Jacob pointed out, but to provide the people of the country with means of obtaining food without the necessity of raiding and seizing it by force.

I should like, in conclusion, to express to Captain Hay the tremendous pleasure which I have derived from what he has told us this evening and from looking at his excellent photographs. Though it is many years since I was in that part of the world, the photographs of those dry, rugged yet fascinating mountains brought back the country to me as if it was only yesterday that I had visited it. I can assure Captain Hay that to me at least, and I am sure to most other people in this audience, he has given a very real pleasure.

The PRESIDENT: Captain Hay has given us a full and admirable account of a region that most of us know very little about. I think, as he said, and as Lord Ronaldshay has indicated, it is a country which has always suffered from perennial over-population. We must not pat ourselves on the back and think we are free from that. We have several million too many in this country already, and they are increasing every year; in particular the sister isle is sending us over a large number of people who might preferably emigrate to the Dominions. The situation all over the world is exemplified not merely by Waziristan. The world-population is growing at a frightful rate. Some say it is only increasing at the rate of 10,000,000 a year; others say 20,000,000; at any rate you have only to multiply either figure by one hundred years to see what it means. It is certain that the various measures that are being taken on the North-West Frontier are all to the good, and we are very lucky indeed to have officers who can deal with the tribesmen in the way that Captain Hay managed the people that he was in charge of. In thanking him I think you will wish me to say that we all hope that his visit to Pre-Ghal will meet with the success it deserves.

Lieut.-Colonel C. H. Stockley sends the following note as a contribution to the discussion on Captain Hay's paper:

I have read Captain W. R. Hay's paper on "Pre-Ghal in Waziristan" with the greatest interest. In February 1923 I was employed in air reconnaissance over the area traversed by Captain Hay, and had to make sketch-maps of the country from the air, and then, later, in combination with aerial photographs.

The existing map, at the end of 1922, was so inaccurate in the region of the upper Dara Toi as to be not only useless but misleading. The Dashka Algad had been united with the Mandech Algad and the streams to the north-west of Wuchwam, so as to form one main valley. Not a single village east of the Dara Toi–Shawal water-parting was shown in its correct position or by its correct name, so that aircraft when flying west of Makin and north of Pre-Ghal were hopelessly at sea.

Phot. C. H. Stockley

Razmak plateau from the north

The "Map of Upper Dara Toi" was made first by sketching from the air the course of each large nullah (Algad), noting its general bearing carefully, and marking in villages as A, B, C, D, etc. A reproduction of the sketch was dropped on the Intelligence Officer, Waziristan, who filled in the names as best he could with the assistance of local intelligence agents. He then sent the sketch to the air headquarters. Strips of vertical photographs were then taken along the nullahs and a large mosaic made. A tracing was then made from the mosaic, and reproduced (by carbon) on to another large sheet. The names were filled in, the whole sheet given a slight tilt to allow for the general rise of ground from east to west, and it was photographed, a calculation being made to obtain average scale of 1 inch to a mile.

This was a very rough-and-ready method, and allowed nothing for distortion, but it was very quick (an essential at the time) and served the practical purposes for which it was made. Flying conditions were very bad, the weather being stormy, very cold, and the bumps dreadful. Heights of passes were obtained by flying the machine low over the pass two or three times, and noting the results on the altimeter. These results seem to have been relatively good, though consistently slightly in excess. Passes were detected by the tracks of men who had crossed them showing in the snow.

The Lowarai Punga in Shawal was covered with snow on the two days on which I flew over it, and, from the air, looked ideal for winter sports. There were two or three slightly smaller but similar clearings (they would be called "margs" in Kashmir) to the south of the Lowarai Punga.

The photograph of Razin and the Dara Toi shows a big ridge in front of Razin on the south. This is probably that by which Captain Hay made his descent from Pre-Ghal. I had picked it in my mind's eye as a good route up the mountain. Wuchwam village was a remarkable sight from the air. Facing south and walled in at the back by Kwajak Sar and subsidiary ridges, it was a veritable sun-trap and held much less snow than the villages several hundred feet lower down, while the sheer-sided gorges on either side made its site appear very strong in natural defence. The water-parting on the west was difficult to detect from the air, and at first it appeared as if the Garai Algad joined the Mandech Algad immediately south of the village, but this was not so.

Wuchwam was noted in 1923 as being the temporary resting-place of the bones of the Mullah Powrindah: his son having removed them from the grave at Marobi lower down the Dara Toi in fear of violation by our troops. One of the first signs of returning confidence after the occupation of Razmak was the return of the bones to Marobi.

The last mile of the Mandech Algad immediately above its junction with the Dara Toi runs through a deep gorge so narrow that it is said only one camel can pass through it at a time. Consequently nearly all traffic from Mandech goes over the Mandech Narai and down the Dashka Algad.

Colonel Stockley's note contained also certain criticisms of Captain Hay's geography in the neighbourhood of Wuchwam: these have been submitted to Captain Hay, who writes: "I think that what has given rise to the misunderstanding is probably the fact that Wuchwam—a large and scattered village—straggles across the watershed between the Mandech Algad and the Sra Tizha Algad. He has ignored the portion on the Sra Tizha side, and I have ignored that on the Mandech side, because I never saw it." *The Survey of India sheets, on which Captain Hay was working, had been revised recently from Colonel Stockley's air reconnaissance, a photograph of which, with the complete text of his arguments and Captain Hay's notes thereon, have been placed in the Map Collection.*

THE SAILING CHARTS OF THE MARSHALL ISLANDERS:

A paper read at the Afternoon Meeting of the Society, 14 May 1928, by

COL. SIR HENRY LYONS, F.R.S.

NOT a few of the primitive races of man have devised ways of representing some of the features of the region which they inhabit, and have thus produced crude forms of maps.* The Esquimaux of Eastern Greenland were found by G. Holm during his expedition of 1883 to 1885 to be using wooden models of the islands and coast-line, and he describes them as being reasonably accurate.† Dr. A. C. Haddon, F.R.S., in the course of an anthropological survey of the Torres Straits,‡ visited a place in the island of Mer where initiation ceremonies were formerly performed. Here he found stones placed to form a topographical representation of the island group, so that youths, who had been told the legend of the culture hero Malu, could then repeat his journey from island to island by moving from stone to stone in the ceremony. Similarly Arabs and other nomad races will readily sketch on the ground or in the sand the form and relative position of the valleys and hill ranges of any district with which they are acquainted; and many other instances may be given.

But the most striking example of such primitive cartographical effort is supplied by the sailing charts which were made and used by the inhabitants of the Marshall Islands in the Pacific up to the middle of the last century. With their aid the islanders navigated their canoes over long distances in the archipelago, and according to an American missionary, Dr. L. H. Gulick who lived there in 1860, they made voyages of as much as 600 miles. It is to him that the first information of the sailing charts is due,§ but his account contained some inaccuracies and was amplified by Captain J. H. Witt in 1875. A much fuller account was published in 1898 by Captain Winkler,‖ who, during a lengthy stay in these islands in 1897 and 1898 and at the expense of much time and trouble, gained very valuable information about the meaning and method of using these charts.

The most complete account of them which has appeared is one by A. Schück,¶ and the object of the present paper is to supplement his work by giving details of an interesting series of five of these charts which are now at the Science Museum, South Kensington.

Examples of these charts were first brought to Europe by Consul Hernsheim in 1879 or 1880 from the island of Jaluit, and soon afterwards five were received by the Godeffroy Museum at Hamburg.

Schück in 1902 recorded 43 examples as being then known, of which 29 were in Germany, 6 in the United States, 3 in Honolulu, 2 in Sydney, 2 in

* W. Drober, 'Kartographie bei den Naturvolkern.' Erlangen, 1903.

† Cf. *Meddelelser om Grønland* vol xxxix (1914), W. Thalbitzer, "The Ammassalik Eskimo," p. 665.

‡ 'Reports of the Cambridge Anthropological Expedition to Torres Straits,' vol vi, p. 304. Cambridge, 1908.

§ *Nautical Magazine*, 1862, vol xxxi, p. 304.

‖ *Marine Rundschau*, 1898, pp. 1418–1422.

¶ 'Die Stabkarten der Marshall-Insulaner.' Hamburg, 1902.

Great Britain, and 1 in Vienna. Others may have been acquired since, but I have no knowledge of any except one which is in the British Museum and the five which are being shown to the Society to-day. These five were collected by Sir George Le Hunte, G.C.M.G., who was Governor of Fiji in 1875, and were presented by him to the Royal Colonial Institute · they have now been lent to the Museum by the Council of the Institute for exhibition.

All these charts are of similar construction : narrow strips of the centre-rib of a palm leaf are arranged in certain forms and positions, and are tied together with lengths of palm fibre. The information is conveyed by the relation of the various wooden strips to one another and the forms which they take. Dr. Gulick believed that the strips indicated the currents which would be met with during the voyage, but Captain Winkler found that they were really intended to represent the wave front of the swell caused by the prevalent winds. The curved rods indicate that, while the swell movement is checked in the neighbourhood of an island, in the open sea it sweeps on unhindered ; areas where two swell fronts intersect are those where rough water may be experienced. Currents in the neighbourhood of islands are sometimes shown by short straight strips, and long straight ones may indicate the direction in which a certain island lies.

Islands are marked by small shells which are tied on to the palm-rib framework, and indicate only very approximately their positions.

Captain Winkler has grouped these Marshall Island charts in three classes according to the purpose for which they were made, and gives the native names for them :

1. Mattang : this is a chart prepared for instructional purposes only. It usually represents a very simple case such as that of a single island at the centre of the map, with curved swell fronts arranged in four quadrants. These are usually constructed symmetrically in order to present a simple set of conditions.
2. Medo or Meddo : these include a portion of the island archipelago only ; usually four or more islands are indicated, but in any case not nearly so many as in the charts of the next class.
3. Rebbelib : charts of this type include the whole of the island group, or at least one of the two parts, the eastern or the western into which the Marshall group is divided. They are of various forms and sizes, and since they are not to any scale and only approximately correct in their orientations any comparison between the various examples known is difficult to make.

Those of the Royal Colonial Institute include :

Three Mattang charts.
One Medo chart.
One Rebbelib chart.

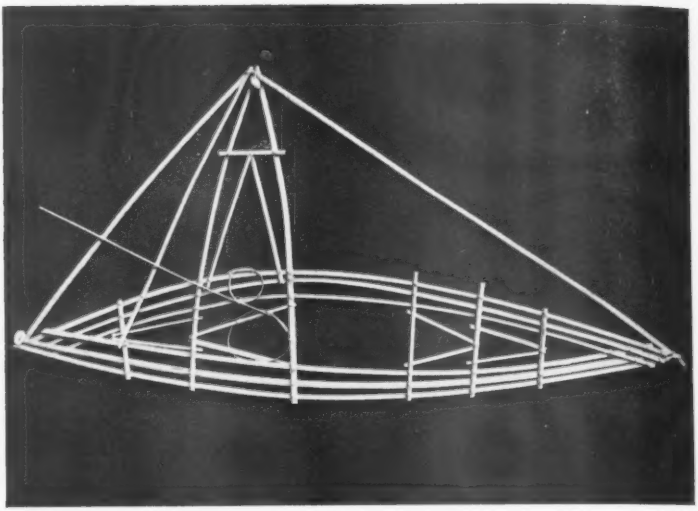
One Mattang closely resembles those at Berlin and Bremen as figured in Schück's monograph (Plate II, figs. 9, 12).

The second one seems to be of an unusual form, and not to resemble any of those in other collections.

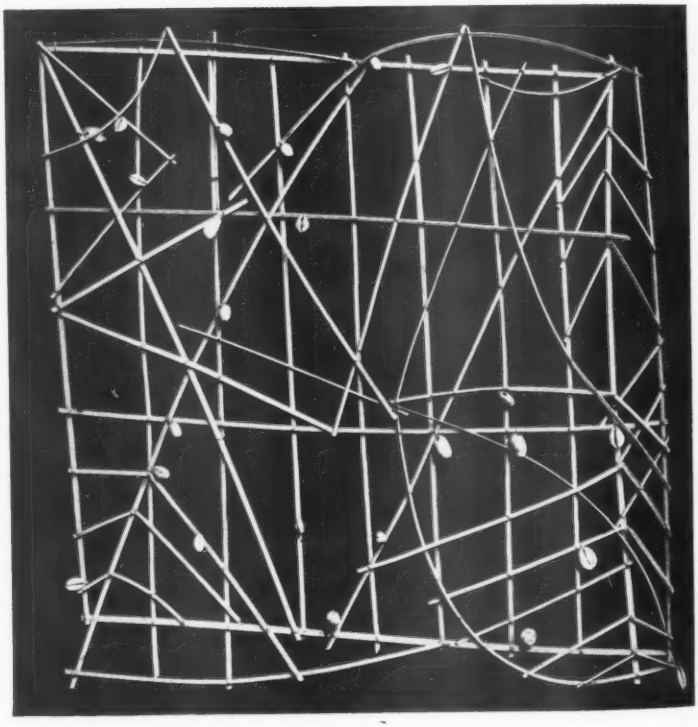
The third example is much larger and includes at least five island positions. Its symmetrical form indicates that it was for instructional purposes, and it

Mattang: instructional chart

Mattang: educational chart



Medo: local chart



Rebbelib: general chart of island group

is therefore placed in the Mattang class. The framework in this case is tied together with cotton string and not with palm fibre.

The Medo type of chart is precisely the same as one at Stuttgart which is figured on Plate VII, fig. 42 of Schück's publication, and it can therefore be said that the islands which are represented by the shells on it are Ebon, Nemorik, Kili, and Ailungslablab, while Jaluit should be represented by one in the centre which is missing. It is known that the Stuttgart example was made by the chief Nelu, and so perhaps he made this one also.

The Rebbelib example bears some resemblance to the one at Munich (Schück, Plate III, fig. 27), but is more complicated in its arrangement. There is little doubt however that the shells in the right-hand and left-hand bottom corners represent the islands of Ebon and Bikini respectively, so the line between them bears about S.E.–N.W.

All these are of very fragile construction and could not possibly have been used on the canoe voyages. It is known that the construction and use of these charts was kept secret and jealously guarded by the chiefs, so we may conclude that they were used for study ashore. The example of a Rebbelib which is at the British Museum is of much stronger construction.

Unfortunately, the Royal Colonial Institute received no documents or details with these very interesting objects, and this makes any identification of the islands which are indicated on them difficult. Indeed, it is only possible to do this in cases where they closely resemble those in other museums for which the information exists.

DISCUSSION

Before the papers the PRESIDENT (Colonel Sir CHARLES CLOSE) said: We have three interesting subjects to discuss this afternoon, and first Sir Henry Lyons is to describe the Marshall Island stick charts. Sir Henry has written a very interesting account of them, and I suppose very few know much about the charts beyond the fact that they existed, since they have been mentioned in several books: for instance, in Mr. Reeves' book on Map-making. I will ask Sir Henry Lyons to commence.

Sir Henry Lyons then read the paper printed above, and a discussion followed:

Prof. E. H. L. SCHWARZ: I should like to ask a question. Sir Henry Lyons referred to the difficulty of using these frail charts on a canoe, but was it not a fact that the Pacific islanders used to build quite big boats with boarded sides, capable of journeys of a couple of months or so? I recently saw a reference to that effect, and I should like to know whether Sir Henry Lyons could throw any light on the subject.

Sir HENRY LYONS: I do not know that I can add much, because all my information is second-hand. I cannot imagine any one caring to make use of these charts and handling them for long under the confined conditions on board even a large canoe, for the charts are very fragile, and the palm-leaf strips are only tied together by a few strands of very thin palm-fibre. It is said to have been the custom of the Marshall islanders to sail in groups of thirty or forty canoes as far apart as they could see from one to another, or from the mast of one to another, so that they really swept a very considerable breadth of sea, and so had a better chance of making any particular island for which they were steering. I suppose we ought to take the charts as a graphical presentation of the oceanographical phenomena in the neighbourhood of the archipelago with which they were

acquainted, especially as regards the prevailing swell directions, the prevailing currents in the neighbourhood of the islands and broken water in certain places. If we consider the prevailing winds from different quarters, there is no even distribution of them into any four quadrants. There are periods of the year when winds are almost exclusively in one quarter, north-east and south-east, and no doubt direction of swell was a very good guide during that season. But I doubt whether we can attribute any great topographical value to the charts except in the case of the Medo or local maps where the islands were not very far apart.

Dr. BRISCOE: Sir Henry Lyons said that the maps in this simple form had ceased, about fifty years ago, to be any use. Is it possible to infer in any way at what time they came into use? I suppose it was a gradual process beginning with something even simpler than the types exhibited here to-day.

Sir HENRY LYONS: The American missionary, Dr. Gulick, speaks of the charts being still in use when he first saw them, but they ceased to be used a few years afterwards.

Dr. GUNTHER: Sir Henry Lyons has mentioned the example in the Pitt Rivers Collection at Oxford. As it only measures 18 inches by 11 inches, I do not think the argument as to frailty would apply. It would be so light that it would not suffer damage.

[*Note added later.*]

It was presented to the collection in 1897 by Dr. Irmer, who obtained it from the Chief Nalu of Jaluit. Six islands are represented by shells, four, namely Namurik, Kili, Jaluit and Mili, lie approximately in a straight line across the middle of the chart, while Ebon and Ailinglap lie out nearly at the apex of equilateral triangles based upon the line between Namurik and Mili.

The CHAIRMAN: We are very much indebted to Sir Henry Lyons for having given us a paper on a subject that so few of us knew much about beforehand. I am sure he has collected all the information available on the subject of those very remarkable maps, and I should like to congratulate him on getting those examples from the Royal Colonial Institute on loan for the Science Museum, South Kensington, where we can all see them, in connection with his other great collections in the department which he conducts with so much efficiency and so much to the benefit of all interested in science. I beg to thank Sir Henry for his paper.

WILLIAM BOURNE: A CHAPTER IN TUDOR GEOGRAPHY:

A paper read with the preceding at the Afternoon Meeting of the Society, 14 May 1928, by

MISS E. G. R. TAYLOR

THE history of the adaptation of astronomical theories and observations to the practical needs of navigation has been very thoroughly explored, and it has been shown by Bensaude and others that the Portuguese seamen of the fifteenth century owed little to the German humanists, but much to the Jews of the Western Mediterranean. The adaptation, or perhaps more truly the re-adaptation, of geometry to the practice of geodesy and cartography has attracted less attention, but in this case the debt of the surveyor and the cartographer is certainly to Central Europe. In Nuremberg during the last half of the fourteenth century, Regiomontanus and his disciples taught, not only the use of the astrolabe and cross-staff for astronomical purposes, but also the use of the cross-staff and the geometrical square for everyday practical measurements; while at the same period the Nuremberg city craftsmen, famed all over Europe for their beautifully made instruments, excelled themselves in the construction of compasses, designed not for mariners but for travellers by land, who carried road maps. A compass was commonly known, in fact, as *organum viatorium*.

Just at the time when the intellectual and practical activities of Nuremberg were making cartographical survey a possibility, the stimulus to its actual undertaking was supplied by the recovery of Ptolemy's Geography, and by the multiplication of MS. copies of this work between 1409 and 1474. In Book I the great Alexandrine geographer lays down the fundamental principle of geography, namely, the accurate fixing of position: if possible by latitude and longitude astronomically determined. This new concept of what a map should be made a profound impression, and certainly not later than 1475 the maps accompanying some of the MS. copies of Ptolemy included Tabulæ Novæ drawn on the new principle.

In Italy the method of obtaining detail for such maps was naturally by an adaptation of the mariner's compass, individual positions being fixed by compass-bearing and distance. This is made clear by Niccolo Tartaglia, the Brescian *savant*, in his *Quesiti et Inventioni* (Venice, 1546), a book containing material gathered much earlier than the date of publication. The dedication of this work is to King Henry VIII, and the author says that he recalls how, in discourse with his "compeer," Richard Wentworth, he had learned of the English King's interest in military affairs, and since the book was largely concerned with gunnery, addressed it to His Majesty. This Richard Wentworth was a gentleman of Suffolk, who was at the Field of the Cloth of Gold; he probably died about 1529, since he then no longer appears as a Commissioner of the Peace, and the date of his meeting with Tartaglia is not recorded. In the *Quesiti*, which is cast in dialogue form, he is represented as saying: "Compare carrissimo, Haria molto accaro che me dechiaristi, come se poteria messere in disegno rettamente un sito ouer un particolar paese, et simelmente la pianta di una citta, la cui practica da Ptolomeo come sapeti nella tua Geographia, è detta Chorographie?" Niccolo replies that a

compass is employed, and that there are two instruments, one the more convenient, the other more commonly employed. The instruments are reproduced in the accompanying figures (Figs. 1 and 2), that with the small

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la iſtremita del brazzo.c.d.uiſe potra incaſſar, & incollar el brozzetto. e f. a ſquadro come nella ſopraſcritta figura appare. Et dapoi queſto nel Centro di tal dioptra biſogna fa: ui un buſettino & con un pironcino di ferro, ouer di ot tone piantare tal dioptra nel centro di tal iſtromento, laqualcoſa facendo tal iſtromēto ſtara preciſe come di ſotto appar in figura, et di queſto uene potrai

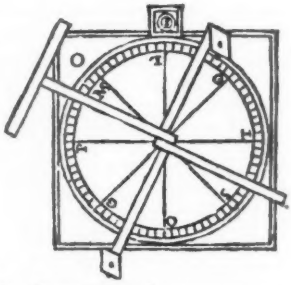


Fig. 1. *Surveying Instrument, in common use c.* 1530 (*N. Tartaglia*)

ouer traſguardo, ſara girabile, cioe che la ſe potra girare per ogni uerſo a torno à torno, & per quelli dui buſettini che ſaranno in quelle due lamette quadrā gole in alto elleuate, ſe potra traſguardar con uno occhio li ſegni, & termini che ſi uora uedere, come per lauenire p eſſempio ſe moſtrara, uero è che in luoc co de quelli dui buſettini à mi me piace, et me pare anchora piu ſpediēte, due

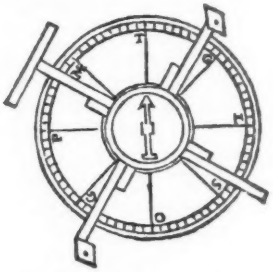


Fig. 2. *Surveying Instrument, second type* (*N. Tartaglia*)

inset compass being the usual pattern. The " more convenient " type with the large, centrally placed compass must have been more difficult to construct, as the sight rule and T-square had to be attached to a collar which turned about the compass.

The scale graduation was, of course, according to the 64 points of the

compass then in use in Italy. It was the discovery that William Bourne described in 1578 a Topographical Instrument (Fig. 3) thus graduated (although with only 32 points according to the English use), whereas Leonard Digges' famous "Instrument called Theodelitus" of 1571 had a scale of degrees, that led to the present inquiry. Before, however, tracing the connection between William Bourne and Tartaglia, the history of Digges'

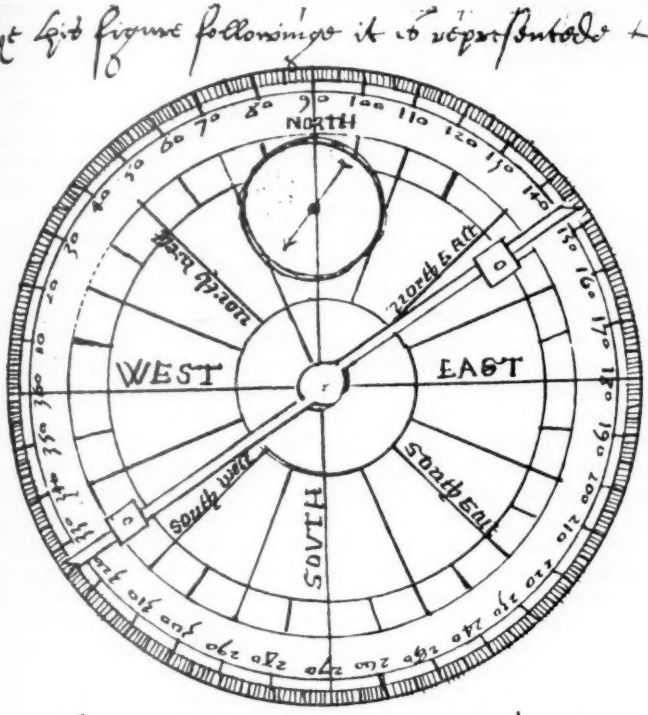


Fig. 3. Surveying Instrument, William Bourne, 1567–70
(Sloane MS. 3651, British Museum)

theodolite must be sketched out, and explanation given of the fact that both Bourne and Digges employ their instruments for triangulation, and not merely, as Tartaglia did, for bearing and distance determinations.

It is necessary then to return to events in Nuremberg. Here, towards the close of the fifteenth century, a new type of map had appeared, showing roads marked off in miles, and designed for use with the Compass, or *organum viatorium*. The earliest extant example is the *Rom-Weg* of Erhard Etzlaub,

himself a compass-maker, which was published in 1492. Waldseemüller's *Carta Itineraria* of 1511 is of the same type.

To Waldseemüller are also due the famous maps of Lorraine and the Rhine Valley, printed as " Tabulæ Chorographiæ " in the 1513 Ptolemy. An instrument for taking horizontal bearings, but graduated in angular measure (*G.J.* 1928, p. 477), is shown attached to a treatise by Waldseemüller on Architecture and Perspective (1512), and a similarly graduated horizontal circle was used by Gemma Phrysius, of Louvain, who is the first to describe position-fixing by intersecting rays. Gemma makes use of a movable compass for orientating his instrument, but his contemporary, Orontius Finæus, of Paris, who died in 1555, made a Geographical Planisphere (pictured by Gallucci in his *Della fabrica et uso de diversi stromenti*, 1597), which had an inset compass, with a mark cut to show the magnetic variation, such as was made on the Nuremberg compasses. The nephew of Gemma Phrysius, Gualterus Arsenius, made a similar instrument.

The link between these continental cartographers and Leonard Digges is the latter's friend, the famous mathematician and reputed student of the " black art," John Dee. John Dee was made a Fellow of Trinity College, Cambridge, in 1546, the same year that the younger Digges, Thomas, who became a noted mathematician, matriculated at that University. Dee expressed a high opinion of Digges' work, and their lifelong intimacy is witnessed by Dee's letters and by the loan of money which the philosopher obtained from his friend when both were elderly men.

In 1547 John Dee went to Louvain, and became a disciple of Gemma Phrysius (1509–1555), the University Professor of Mathematics. He began, too, his lifelong friendship with Gemma's pupil and former assistant, Gerhard Mercator, who had already published his large map of Flanders based on an older one drawn by the new methods. After a brief return to Cambridge, Dee was back in Louvain as a registered student for two years, only leaving that University in 1550 to go on to Paris, where he pursued his mathematical studies under Orontius Finæus (1494–1555), and himself publicly lectured on Euclid's Elements. The influence of Gemma and Orontius upon the young John Dee (he was then in the twenties), was deep and lasting, and in particular it was from Gemma Phrysius' globes that he derived his most powerful arguments (put forward in part through Sir Humphrey Gilbert) for the existence of a North-West Passage to Cathay. He could, and did, argue with equal force for a north-east, a north, and a land passage, for his consuming desire to get into touch with the land that Marco Polo described was based on " secret reasons," doubtless connected with his search for the Philosopher's Stone.

Dee returned from the Continent in 1551, although making several subsequent visits, and later settled down at Mortlake on the Thames. In 1553 Leonard Digges published his first book, *Prognostications*, containing rules for the conduct of life in accordance with the aspects of the heavens. This was re-issued in an enlarged form in 1555, when he promised in the preface his first book on Practical Geometry, called *Tectonicon*, which duly appeared in 1556. This little book for " Artificers, Surveyors, Land-Meaters, Carpenters, Masons, etc.," has a special section on the " Profitable

Staff," actually the cross-staff, an instrument to which Gemma Phrysius had devoted particular attention, and which was also thoroughly dealt with in de Rojas' popular treatise *De Astrolabio*, published in Paris in 1550, and brought thence by John Dee. De Rojas borrows directly from Gemma Phrysius the account of triangulation, together with the explanatory diagrams, which are included in this work, and it is undoubtedly one of the sources which Leonard Digges drew upon in his *Pantometria*, the book containing "Theodelitus" and the "Topographical Instrument" which embodies the principle of the true theodolite. Leonard Digges died probably soon after 1556, and his *Pantometria* was finished and published by his son in 1571.

Four years before the publication of the *Pantometria*, William Bourne had issued his first attempt at Popular Science, for such seems the most just description of all his writings. This singular man, who was about the same age as John Dee and the younger Digges, was a native of Gravesend, where he spent his whole life. He was at one time an innkeeper; he also served as a gunner (probably on the bulwarks at Tilbury), and as portreve he was a man of some note among the townsfolk of Gravesend. Beyond all this, however, he was both a keen reader (a student of Mathematics, as he describes himself) and an intensely practical man; whatever he read, he wished to see translated into terms of use, and this translation was the task he undertook. All his books show clearly their derivation from contemporary writings, but Bourne was in no sense a plagiarist. His situation at Gravesend determined that he should address his writings especially to seamen and explorers, while his experience as a gunner led him also to undertake the discussion of military problems. His self-appointed task was to bridge the very patent gap between the academic mathematician and the actual ship-master, pilot, or master-gunner with whom he was in daily contact.

To understand William Bourne, and to estimate his importance, it is necessary to review the position of the Science and Art of Navigation in England in his day, a task that can be attempted in merest outline only.

So long as Sebastian Cabot lived and was Chief Pilot of England, a knowledge of Navigation (such as he was reputed to possess) was a carefully guarded secret, to be sold to the highest bidder. Whatever he imparted by word of mouth to Richard Chancellor, who was Chief Pilot of the fleet for Cathay in 1553, and later to Chancellor's successor, Stephen Burrough, in 1556, Cabot's written "Ordinances, instructions and advertisements" contain nothing of any importance whatsoever, and on his death-bed, in 1557, he was still talking (as Richard Eden reports) of his "secret" method for the determination of longitude. William Bourne must have seen the "good old man" in 1556, dancing and merry-making at Gravesend during the "send-off" of the *Searchthrift*, and had every opportunity of discussing with those concerned the conduct of the series of Muscovy voyages, including that on which the first Russian Ambassador to England (who arrived in a shipwreck) set out from Gravesend on his return home with Anthony Jenkinson.

The death of Cabot, and the advancement of Stephen Burrough to a position of authority, had important consequences. This extremely able seaman visited Spain, probably in 1558, and was received as an honoured

guest at the *Casa de Contratación* at Seville, where he witnessed the stringent examination of Masters and Pilots. As a result, he asked the Governors of the Muscovy Company to make arrangements for the translation and publication of the most recent of the Spanish manuals of seamanship. The work chosen was Martin Cortes' *Brevo compendio de la sphera y de la arte de navigar*, itself deriving from a long series of previous manuals, including that of the famous cosmographer, Pedro Nuñez (Petrus Nonnius). The translation was entrusted to Richard Eden, and was completed in 1561, under the title of 'The Arte of Navigation'; new editions were demanded in 1572, 1589, and 1596.

Copies of William Bourne's first printed work are no longer in existence, and indeed according to his own reference to it, it was no longer to be had in 1578. The title, 'An Almanacke & Prognostication for iii yeres, with serten Rules of Navigation, 1567,' suggests the influence alike of Digges' Prognostications and of Eden's Translation; and that the booklet found a sale is suggested by the issue of a new Almanacke and Prognostications in 1571, when the original one was out of date. Of much greater importance, however, was *A Regiment of the Sea*, which was first published in 1574. By this date Bourne had read, and, as he himself makes plain, been influenced by, not only the *Arte of Navigation*, but the *Tectonicon*, *Pantometria*, and above all John Dee's famous *Mathematicall Preface* to the English translation of Euclid's Elements, published in 1570. This work placed navigation in its correct relation to the fundamental sciences of arithmetic and geometry, and incidentally throws light on Dee's own contributions to nautical science which will be mentioned in a separate paper.

The full title of Bourne's work is *A Regiment for the Sea; Conteyning most profitable Rules, Mathematical experiences, and perfect knowledge of Navigation, for all Coastes and Countreys; most needful and necessary for all seafarying Men and Travellers, as Pilots, Mariners, Merchants, etc., exactly derived and made by William Bourne*. The Dedication is to the Earl of Lincoln, Captain-General of the Royal Navy, and in it the author says: "It came into my remembrance how necessary a thyng it was for seafaring men to have some good instructions: whereof I have written this base and simple Regiment for the Sea, and Rules of Navigation." The Preface to the Reader is marked by the diffidence of a writer who knows that he is encroaching on the field of "learned men," but according to one of the versifiers whose weak but commendatory rhymes prefix the text,

> "Thou hast beside all this, the Truth
> By *practice* truly tride."

and that Bourne is giving the fruits of experience is borne out incidentally in the text over and over again. According to the same Preface, the book contains "necessary things meete to be known in Navigation, and not mentioned in the booke of Martin Curtise (*sic*), called the Art of Navigation." There is, for example, a simple table of the Declination of the Sun, with directions for its use in finding the latitude, whereas Cortes gives the successive positions of the Sun in the Signs of the Zodiac, with a second table of declination of the Signs, which demands much more complicated calculations. Bourne is especially careful in dealing with the taking of position in

the southern hemisphere, since he has known sailors who, having lost their familiar stars and marks, have beaten up and down by " Ginnie and Bynney " unable to proceed.

His discussion of the variation of the compass is of the greatest interest. He repeats Cortes' warning " not to meddle with the mending of the compass, or whettynge of the side of the needle to make it stand due north," and then goes on to the vexed question of proportional variation and its relation to longitude. Here he very sensibly says, " No Maister or Pilot of a shippe doth keepe so simple account of the shippes way, but that he may know what distance he hath into any place, better than he shal know by the varying of the compass : also whether it be or not, that the compass doth keepe any such proportion in the variation, I do refer that unto them that have tried the experience thereof : for I for my part can say nothing in that matter." He inclines to the opinion that the variation of the compass depends in part upon the meridian upon which it was " touched " by the lodestone, but admits that he has inquired of those who had been to America (*i.e.* with Hawkins) as to how needles stand that are made over there, and none can inform him.

In repeating Cortes' directions for making an Equinoctial Dial (a sun-dial which could be adjusted for any latitude), he remarks that he knows only one master who possesses such an instrument, and that even he has obtained it merely to brag of it, and not for use. Indeed, he says, masters commonly possess instruments which they are incapable of using.

The success of the *Regiment* (there were, in all, three authorized editions, and one unauthorized) probably encouraged Bourne to put his further ideas into print, for in 1578 he issued his three remaining books, *A Treasure for Travellers*, *Inventions & Devices*, and *The Arte of Shootyng in Great Ordnaunce*, the substance of which was in MS. before 1571. The two latter reveal the influence of Niccolo Tartaglia, whose *Quesiti et Inventioni* opens with a discussion of range-finding for the cannon newly in use, on lines which Bourne closely follows. In the text the latter mentions his study of the Italian work, and this therefore suggests the answer to the question originally raised, as to how a " topographical instrument " of the Italian compass-divided type, came to be described by the self-taught, untravelled Englishman of Gravesend. Incidentally, the example of triangulation with this instrument given by Bourne, that of a piece of country round Gravesend and Tilbury on the half-inch scale (1/52,800 on the older MS. sketch preserved in the British Museum, which is here reproduced as Fig. 4), is sufficiently accurate to dispose of the suggestion that he talked about the instrument, but neither made it nor used it.

This account of elementary surveying is to be found in the *Treasure for Travellers*, which deals with practical measurements of all kinds, and has besides a very interesting section on the origin of certain land forms, *e.g.* cliffs, islands, marshes. The debt to Leonard Digges and John Dee is fully acknowledged, but in his Preface Bourne says, " I doo not intend to make my booke to teach them that are cunning and learned ; but the only cause of my writing this book is, to instruct and teach them that are simple and unlearned."

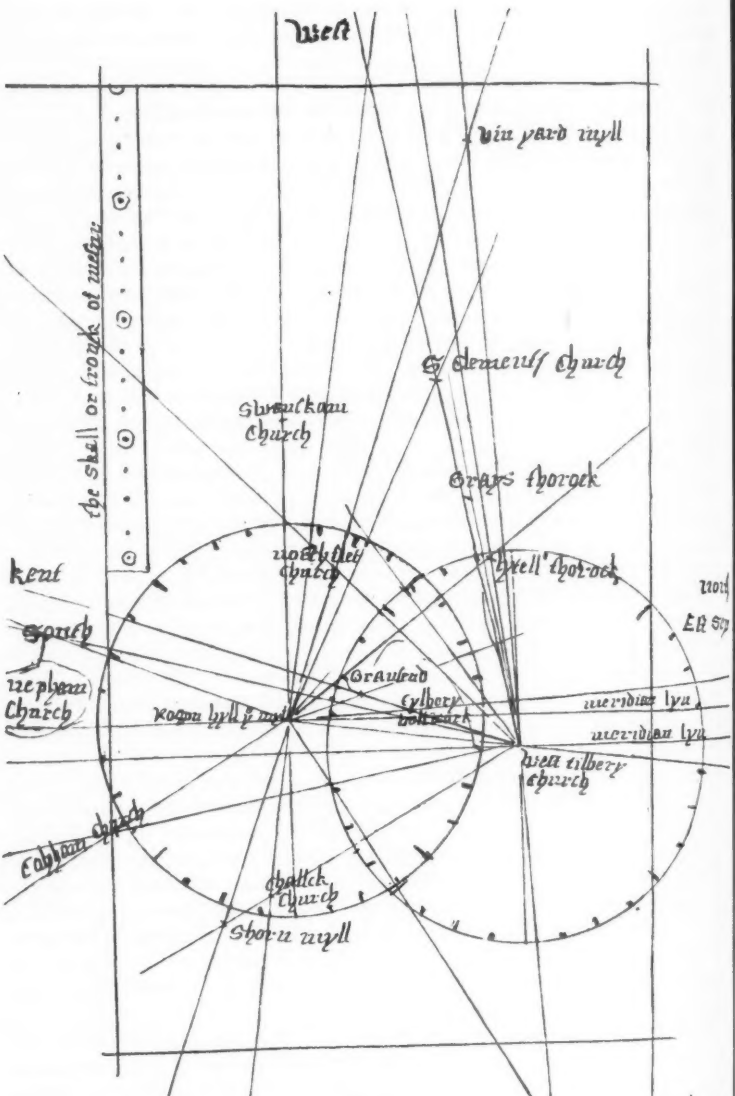


Fig. 4. Bourne's Triangulation round Gravesend and Tilbury, before 1570
(Sloane MS. 3651, British Museum)

It cannot be claimed, however, that either Bourne or Leonard Digges was the first Englishman to describe in print the principle of triangulation. This honour belongs to Dr. William Cuningham of Norwich, who was at Cambridge when John Dee returned from Louvain with the instruments and books of Gemma, Orontius, and de Rojas. Cuningham wrote his 'Cosmographical Glass' in 1558, and published it in 1559, and its derivation from the Continental authors is obvious. He describes how to fix the site of a town by two "angles of position" (Gemma's phrase), and pictures an instrument graduated "like a mariner's compass," similar to, but not identical with, Bourne's.

One of the most important of the "Inventions & Devices" described by Bourne is the apparatus for measuring the "way or going of a ship," which is said to have been made by Humphrey Cole, well known as a contemporary scientific instrument maker. Cole, however, was not the originator of this device; it is one of the many depicted by the inventor, Jacques Besson, "Master of the Engines to the French King," in his *Théâtre des Instruments*. Attention was drawn to it by Richard Eden, who had met Besson while he was on the Continent (1563–73). The French inventor confessed that he left to practical men familiar with the sea the task of working out the details of the cogs and dials described, which were to make the instrument register in miles the distance covered.

It is worth noticing that another book of Besson's, *Le Cosmolabe* (1567), dealing with the construction of a "universal" measuring instrument, throws some light on the practical details of contemporary map-survey. He gives, as the essential equipment of the Cosmographer, a compass, a large jointed ruler (see Fig. 5) called a "sauterelle" for measuring the turns of the road, and a device for registering distance. For the latter he recommends a mule litter, with a single large wheel, geared by cog-wheels to a dial, so that the surveyor, sitting within it, reads off the distances, and transfers them to his parchment as he travels.

From the second (authorized) edition of William Bourne's *Regiment of the Sea*, we learn that he came into personal contact with John Dee, visiting the "great learned man," as did even Queen Elizabeth herself, at his house at Mortlake. The talk was on a favourite theme of both—the voyage to Cathay—and to confirm his arguments Dee showed his visitor this and that written in a book, a book which, as the context reveals, was none other than the *Travels of Marco Polo*. It was for this same edition of the *Regiment* that Bourne wrote his *Hydrographical Discourse of the Five Ways to Cathay*, the date of which is probably 1579 or 1580, *i.e.* before Drake's return from his World voyage. Much new material is embodied in the text of the *Regiment* itself (besides a revision of the declinations), and one new passage runs, "There is devised by one Norman a compasse-maker, a very necessary device in the compasse, that you may set the north point, upon what degree you list, according to the true variation of the compasse." This instrument is described by Robert Norman in his book *The Newe Attractive*, published in 1581.

That Bourne's work was taken seriously by his contemporaries, we learn from the reference to his method of topographical survey, side by side with

that of Digges, in Blagrave's *Familiar Staff* (1590) and in Blundeville's *Exercises*, a compendium of information for " young gentlemen " published

DV COSMOLABE. 69

Figure de l'Equerre (qu'aucuns nomment Sauterelle) laquelle s'applique ſur le toiſt de l'Inſtrument en telle extention qu'on en peult auoir affaire pour toute obſervation qui ſe faict par le moyen d'icelle.

de la Iambe de l'Inſtrument, iuſques aux poinctz marquez au plan, qui ſ'appellent Horaires, pource qu'elles vienent des heures de l'Equinoctial. qui eſt la figure du temps & du premier mobile. E par ainſi telles lignes monſtreront les heures au ſoleil, quand (du poinct aſsigné en la ligne Meridiane du plan ou elles ſont) prouiendra vn ſtyle parallele à l'axe du monde.

Senſuit la forme de l'Inſtrument, duquel on doit vſer en c'eſt endroit, laquelle nous auons repreſentée en la page ſuyuante, pour vous en rendre la demonſtration plus-familiere.

L iii

Fig. 5. "*Sauterelle*," *Jacques Besson, 1567*

in 1594. Much more interesting is the apparent direct influence of the relevant section of *A Treasure for Travellers* on the instructions issued by

William Borough, younger brother of Stephen, for the later voyages in search of the North-West Passage.

Both William Borough and William Bourne deserve a more detailed study, for in working for the advance of Navigation, Charting, and Surveying they had tough material to deal with. As Bourne himself wrote:

"I have known within this 20 yeeres that them that wer auncient masters of shippes hath derided and mocked them that have occupied their Cardes and Plattes, and also the observation of the Altitude of the Pole, saying: that they care not for their sheepes skinnes, for hee could keepe a better account upon a boord. And when they dyd take the Latitude they would call them starre shooters and sun shooters, and would aske if they had striken it."

DISCUSSION

Dr. GUNTHER: I have been profoundly interested in listening to Miss Taylor's paper, in which she has brought to light a great deal that has been hidden in some of the rarest books. There is much to be said for getting those books out of the great public libraries, such as the Bodleian and the British Museum, and having them reproduced. They are most entertaining reading. I hope that Tartaglia, to whom Miss Taylor has so frequently referred, may also appear in English. He is a great source of information as to methods that were used early in the sixteenth century and deserves to be better known. If his book appeared in modern English, illustrated by his own pictures, students of the history of instruments would derive great benefit.

I can now only make one or two discursive remarks on the paper, but I should like to say that the mathematician Gemma Phrysius was, apparently, very fortunate in his relations. He had at least two, and perhaps more, nephews of the name of Arsenius who were exceedingly accomplished instrument-makers. They made astrolabes and other instruments of considerable size with great skill. These Arsenius astrolabes were usually associated with the compass which was inlaid in the bracket of the instrument, and I have always thought that proof that these astrolabes, of which the largest, made for Philip II of Spain and 2 feet in diameter, were used for topographical or surveying purposes. While they could not vie with modern instruments in accuracy, they were very good for the time at which they were made. Gemma Phrysius did not do much instrument making himself, but his relations made the instruments on principles laid down by him, and worked under his supervision. Those instruments were probably the forerunners of those made in this country by Humphrey Cole. It would be a matter of great interest to determine who first introduced the magnetic compass in relation to a surveying instrument. No doubt, as Miss Taylor has pointed out, the early way of doing it was to apply a portable sundial to the side of another instrument, very much as our magnetic compass is applied to the side of a plane-table to-day. The earliest portable sundial with which I am acquainted is dated 1451, and there is one in the Lewis Evans Collection of 1481, but they do not seem to have been very widely used much earlier than that. William Cuningham is a person who has always interested me because he illustrated the books with his own hand. He cut blocks, one of which Miss Taylor put on the screen.

Dr. E. B. KNOBEL: I have listened to Miss Taylor's paper with very great interest, especially her remarks with regard to navigation. There is an unsolved difficulty in regard to how the early navigators ever made their voyages. I have read up most of the Spanish, Portuguese and Italian navigators and books on

navigation, especially Eden's, and it is exceedingly difficult to gather how they made their voyages. They had instruments, for instance the fore-staff and the back-staff. I believe, to the best of my information, there is only one example of the fore-staff extant, and that is at Amsterdam. In the 'Astronomica Danica' of Longomantanus there is shown the drawing of a man measuring a lunar distance with the fore-staff. I have tried in vain to find out what they did with such an observation, or how they reduced it to obtain their longitude. The drawing is dated 1640. The early navigators could not have got round the Cape by coasting. They must have had some means of obtaining their longitude, and it would be interesting if anybody could discover the method adopted for determining the longitude by the means they had at their disposal, namely, the cross-staff and back-staff.

Sir GEORGE FORDHAM: I am not qualified to deal with this very technical subject, but I esteem it a great pleasure and privilege to be able to offer my very warm congratulations to Miss Taylor on the work she has undertaken. The work I have been doing, bibliographical rather than geographical, has brought me face to face with the difficulty of an exact conception of the methods pursued by the early cartographers, and I have long desired that this subject should be thoroughly studied. The Polymetrum of 1512, figured in the *Journal*, is quite a revelation as to the instruments at the disposal of the early surveyors, and I am delighted to have such a diagram before me. What we have heard to-day is an extension of the subject. In fact, we are not on really sound ground as to descriptions of the methods adopted by surveyors until the end of the seventeenth century and the beginning of the eighteenth, when the Cassini began to build up the triangulation of France. Then we have sufficient descriptions and particulars of the instruments. Before that we were more or less on doubtful ground. The investigation which Miss Taylor has undertaken will, no doubt, lead to our being well satisfied, not only as to the method adopted but as to the instruments, their form and use. I think it is an extremely fascinating field of research, and I repeat, if I may, my very warm and sincere congratulations to Miss Taylor and, incidentally, to the Society for the very admirable work she is doing.

Mr. HINKS: I should like first to refer to Mr. Knobel's difficulty with regard to longitude, and to ask him whether he has any objection to the proposition that navigators of that age always ran down to the parallel of latitude of their desired point, making what they thought was a sufficient allowance to be perfectly certain to get on the right side of it, and then ran along the parallel. They always had the means of finding latitudes easily, and I imagine right up to the time of the invention of the chronometer that was the method. It certainly is historical record that that was the method adopted at the time Harrison made his voyage with his chronometer, because you will remember that having been at sea for some days and trying to make Madeira there was great controversy as to whether they were not on the wrong side of the island; whether they had not been sailing in the wrong direction, and Harrison assured them, on the faith of his chronometer, if they carried on for another day they would get to Madeira; and they so did, to the great joy of the crew, for if they had missed the island it would, says the chronicle, have been very serious; and reading on one finds it would have been serious, because they were in want of beer! I heartily associate myself in the thanks to Miss Taylor for her most interesting paper, and there are a number of points to which I would refer had I more time. There is the spirited defence of Cambridge and especially, I am glad to say, of Trinity College, against the claims of Oxford to be almost universal in these matters, a point to which I might refer later. I was interested to hear that William Bourne, at any rate for instructional purposes, described two circles and divided them

upon his diagram just in the way that Digges asks us to do in the *Pantometria*. The other point is in regard to the two circles that Miss Taylor said were divided into compass points and into degrees. Unless I counted wrongly, each octant was really divided into nine parts and not eight, so that the division of the circle is actually 5 degrees. Those are two small points and an unworthy contribution to a discussion upon an extraordinarily interesting paper.

Miss TAYLOR: With reference to what Mr. Hinks said with regard to the drawing of the circles, that was part of the method as laid down by Gemma Phrysius in the first instance. Leonard Digges "had" to do it, and William Bourne "had" to do it; it was part of the method, setting out those two circles before drawing the angles. They worked by rule of thumb. As to tracing the connection between the astrologers and later survey work, I have found that one has to go back to Regiomontanus, which is a task I have rather shrunk from, and beyond that to the classical writer, Vitruvius.

With regard to the question of longitude, I do not agree with Mr. Hinks about their running along the line of latitude, because one of the things John Dee did was to prepare *Queen Elizabeth's Tables Gubernatick for the Improvement of Navigation*, and he made calculations for every latitude of the amount by which you would get east or west as you ran along in any compass direction. If in such-and-such latitude you steered towards the north-west, how far had you to go before you got into such-and-such longitude? All those tables were made at the time, and John Dee apparently devoted much of his time to the improvement of navigation and invented a Paradoxall Compass, which, as far as I can make out, was a means of sailing on a great circle. That is, giving you the compass directions to follow in sequence so that, approximately, you sailed a great circle. That is a point I am still investigating, and all my work on John Dee is far from complete.

[*Note added later:* Miss Taylor is of course correct in saying that the early books provided tables equidistant to the traverse tables giving differences of "latitude and departure;" but errors from currents and leeway quickly accumulate, and these tables did not obviate the need for observations of longitude, nor obviate the necessity of running down the parallel, until some accurate longitude method was discovered.—A. R. H.]

The PRESIDENT: We are all indebted to Miss Taylor for her admirable paper, which has raised all sorts of interesting questions. I was much struck by the fact that they actually used a form of triangulation so early as about the middle of the sixteenth century. I am convinced that the sailors who used lunar distances for finding their longitude in early days would have been liable to strike the wrong continent. It is out of the question they could have made any real use of lunars. The difficulty of ascertaining exactly what they did will be cleared up bit by bit. Miss Taylor's paper is one of those to which we shall refer in the future. We hope she will go on with her studies and increase our knowledge of these interesting subjects of which she has given such an excellent exposition this afternoon. On your behalf, I thank her.

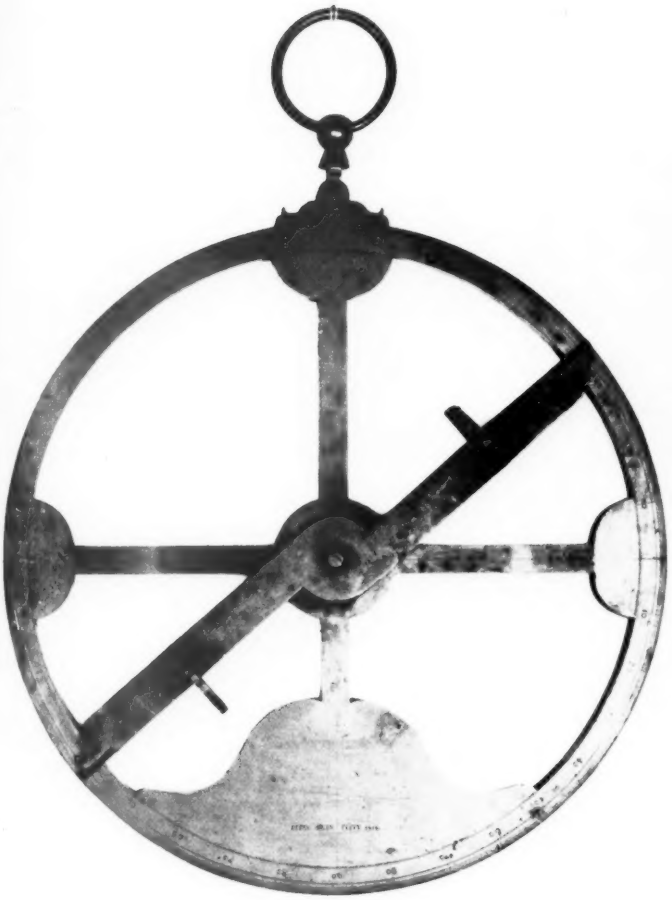
THE MARINER'S ASTROLABE: *A paper read with the two preceding at the Afternoon Meeting of the Society, 14 May 1928, by* DR. R. T. GUNTHER

WHEN Don Quixote felt a bit nervous about the perils of his prospective voyage in the enchanted barque, he prayed for "an astrolabe to take the elevation of the pole." Had he had any acquaintance among those of his contemporaries who did business in great waters, he would have had no difficulty in obtaining his desire, for in his day the seaman's astrolabe was one of the most important and widely used of scientific instruments.

A most interesting representation of a Scottish master-mariner of the seventeenth century is painted on one of many panels in the gallery of the church at Burntisland, where the Merchant Guilds of the town had seats. One of these guilds called the "Pryme Gilt" comprised the shipmasters and seamen. Until quite recent times the panel paintings had been painted over and would have been forgotten but for the fact that in certain lights the underlying drawing showed up in relief. In 1907 an experiment was tried on one panel, many coats of paint and varnish were removed and a naval battle between a ship flying the St. Andrew's Cross of Scotland and another, with a compass over the mizzen mast, was revealed. Now it is said to have been illegal to fly the St. Andrew's Cross except at the fore, after 1606. This indicates that the painting was early. Other figures of ships were found, and on the eleven seamen's panels two are decorated with compass dials, and three with master-mariners, one of whom is observing with his back to the sun with a Davis quadrant, and two with cross-staffs, and each of these two is carrying an astrolabe. Their costume is a four-tailed coat, rosettes on shoes, and moustache. It has been pointed out that the combined cravat and bow at the neck is of the period 1670–80.*

The seaman's astrolobe is now one of the rarest instruments. Employed on every ship from the fifteenth to the seventeenth century for the determination of latitude, it was moulded on simple lines. Designed for use rather than to please the eye, it lacked the ornamental rete that has given the landsman's astrolabe a high permanent artistic value, and when superseded as a navigational instrument, it doubtless passed through the hands of the marine store dealer to the crucibles of the brass founder. Examples of the seaman's astrolabe have thus become exceedingly rare: indeed, until a few years ago it was known in Britain only from a solitary example found at Valencia in 1845 and now in the South Kensington Museum.† The base plate of a second example was found at Vera Cruz. It belongs to the writer and is now exhibited with the Lewis Evans Collection in Oxford.‡ A third, Champlain's Astrolabe, dated 1603 and now in the possession of Mr. S. Hoffman, was dredged from the bed of the St. Lawrence. At a small museum in Normandy, at Caudebec en Caux, is a fourth example, inscribed with the name of the maker "NICOLLAS LE TELLIER MA FAICTE A HONNEFLEUR 1632." But all these were instruments

*Cf. Blome's Encyclopædia, quoted by A. Young, 'History of Burntisland.'
†Lecky, "The Valencia Astrolabe," *Kerry Archæological Magazine*, March 1913.
‡Gunther, 'Early Science in Oxford,' ii, p. 227.



The sea astrolabe of Elias Allen, 1616; St. Andrews' University

Master mariner observing with cross-staff and carrying a seaman's astrolabe ; from the painting on panel in Burntisland church, by permission of Sir John Findlay

Master mariner observing with Davis quadrant ; from the painting on panel in Burntisland church, by permission of Sir John Findlay

of small diameter as compared with the fine example at St. Andrews, which is moreover perfect and is marked with the name and date of an English maker.

In point of completeness it is therefore the premier English Mariner's Astrolabe in the world. There is indeed only one other sea-astrolabe of large size known to me, namely that preserved in the observatory of the University of Coimbra, which is half a metre in diameter.

The St. Andrews astrolabe is inscribed: ELIAS ALLEN FECIT 1616.

The bronze circle, 1 foot $3\frac{5}{8}$ inches in diameter, $\frac{5}{8}$ inch in thickness and $17\frac{1}{2}$ pounds in weight, is suspended by a bracket, shackle and 3-inch ring. The four radial spokes end in massive plates of which the lowermost is much enlarged to serve as a plumb-bob.

On the limb the degrees are numbered in tens 10–90, starting from zero on the horizon to 90° at the zenith. The alidade was therefore used to measure altitudes above the horizon rather than zenith-distances, which were often marked on astrolabes.

In three of the quadrants the degrees are subdivided to $\frac{1}{4}$ degrees, but in the left-hand upper quadrant the graduation is by transversal lines, one to each degree, and drawn zig-zag across five concentric arcs, so that readings can be made to $\frac{1}{5}$ degree, *i.e.* 12 minutes.

On the larger Coimbra instrument two opposite quadrants are similarly divided, but there the transversals facilitate readings to tenths of degrees.

The sight vanes on the alidade are provided with slit and pinhole sights, and are $8\frac{1}{2}$ inches apart. The ends of the alidade are pointed and bevelled to a fiducial edge on one side for facilitating accurate reading.

Though it would be idle to speculate on its past history, yet it is apposite to recall the fact that in 1616, the year of its manufacture, William Baffin returned from the northern voyage in which he charted Baffin's Bay, and took service on an Eastern voyage from which he never returned. Elias Allen was already established in Black Horse Alley, near Fleet Bridge, as an instrument maker of repute, before the *Discovery* sailed in quest of a North-West Passage in 1615. The St. Andrews astrolabe therefore represents in all probability to us the type of instrument by which Baffin would have obtained his latitudes. It will be remembered that upon this notable voyage Baffin got 300 miles nearer the pole than previous navigators, and in Smith's Sound he discovered the greatest known variation of the compass.

The St. Andrews instrument does not however show signs of hard wear or of distant voyaging, but then it may have been kept from harm in a box as carefully as a chronometer now is.

In the Physical Laboratory of the United College at St. Andrews Allen's astrolabe is associated with the great 2-foot astrolabe made by Humphrey Cole in 1575; with an armillary sphere by the same maker dated 1582; with an early Dutch or Flemish circumferentor, and with a dipping needle in a 12-inch circle inscribed with the name of the donor Archibald Areskine. Whether all these instruments came together we do not know, but Prof. Stanley Allen, in whose custody they are, has recently shown (*Nature*, 24 March 1928) that there are good grounds for believing that some if not all were acquired when Prof. James Gregory, in June 1673, was empowered to buy "such instruments

From the painting on panel in Burntisland church, by permission of Sir John Findlay

From the painting on panel in Burntisland church, by permission of

and utensils as he with advice of other skilful persons shall judge most necessary and usefull" for teaching mathematics and astronomy in the University.

Another instrument of the same type is illustrated by a full-sized wooden model in the possession of the Royal Geographical Society, to which Mr. Hinks has kindly drawn my attention. It is inscribed "Astrolabio Nautico de Madeira dos Descobridores Portuguezes. Oficinas do Instituto Superior Tecnico, Lisboa."

The circle is 18·4 inches in diameter. Two opposite quadrants are graduated in degrees. The instrument is provided with a plumb-line attached to a small hook near the suspension ring for testing the truth of the vertical axis before an observation is made and measured. As the addition would be useless upon the moving deck of a ship, this astrolabe must be regarded as an instrument for shore observations only.

DISCUSSION

The PRESIDENT: We are very fortunate to have had Dr. Gunther to describe the astrolabe because he is such a high authority on this subject. We now know what there is to be known about it if we can remember what he has told us. I was surprised to learn there were only six of these mariners' astrolabes in existence, counting the one found at St. Andrews. That was found, I think, about twenty years ago?

Dr. GUNTHER: It has been in the possession of St. Andrews for a considerable time, but I do not think they knew what it was until recently.

The PRESIDENT: Can Dr. Gunther tell us whether that interesting picture of a man using a cross-staff has been published?

Dr. GUNTHER: Only in a little local guide to Burntisland. It is accompanied by a photograph of a man using Davis's quadrant. That is the companion picture, and they really are a most interesting pair.

The PRESIDENT: We have come to the end of our meeting, and I am sure you will agree with me that we have had an interesting series of discussions. We are very much indebted to Dr. Gunther for his communication, and for coming from Oxford to address us. In the name of the Society I have to thank him for his paper.

NOTE ON THE HEADWATERS OF THE YARKAND RIVER

MARGARET GREGSON

DURING the summer of 1927 my husband (Lieut.-Colonel G. K. Gregson, R.A.) and I made a deviation from the main trade route in the course of a journey from Srinagar to Yarkand. Following in the tracks of Colonel Wood, Major Kenneth Mason, and other explorers, we left the Karakoram Pass on our right and branched off to the north-west over an easy watershed to the valley called in earlier reports "Valley A," reaching thereby the country at the headwaters of the Yarkand River, usually known as the Amphitheatre. We were neither trained nor equipped to attempt any exploration of value, but possibly one or two of our observations may be of interest.

Leaving Chajos Jilga camping ground on the main trade route early in the morning of 14 July 1927, we reached a point at the upper or southern end of the Amphitheatre, near the confluence of stream A with the Yarkand River, on the same afternoon. The weather was warm and fine, and the stream rose considerably in the course of the afternoon, but presented no serious difficulty to our ponies. My husband shot some Imperial sand-grouse for our larder near the watershed, but we saw no other animal life except one female Tibetan antelope and her calf. The crows, vultures, and other birds of ill omen which haunt the trade route were left behind us, along with the corpses of pack-animals which decorate that "Via Dolorosa."

We rested for a day in our first Amphitheatre Camp, going for an easy morning walk up over the slopes of the hills overlooking the Yarkand River (valley B) towards its source. We took nine butterflies, eight closely resembling the *Baltia Butlerii* (which was taken by the Mount Everest Expedition) and one *Colias*. My husband, during the afternoon, saw many Tibetan antelope in the neighbourhood of Hayward's Lake—mostly females and young ones. Ibrahim, our Karakash, a young Argon from Shushot, who had been to this country with Major Mason's Expedition in 1926, said that the male antelope would be found lower down the Yarkand River. We found that he was right.

Travelling by easy marches down the Yarkand River we eventually reached the junction of the Lungmo Che (stream I of Colonel Wood's report of 1914) on July 19. We went up this valley about 6 or 7 miles to a camp on its left bank, in a small side valley where there was excellent grazing and plenty of burtsi for fuel. My husband and his Kashmiri Shikari, Muhammad Rattar, searched the hills for the herds of large bharal mentioned by Dr. Clifford in Major Mason's report, but without any success. Only one herd of nineteen ewes and lambs was seen, about 10 miles up the Lungmo Che valley. They continued the search with telescope and glasses to a distance of about 17 or 18 miles from the junction of this valley with that of Yarkand River. No other bharal were seen. It is a problem where they may hide themselves, as the southern side of the Lungmo Che is steep, stony, and interspersed with glaciers, and valley J adjoining is reported to be entirely barren. The Lungmo Che valley however affords good grazing in many places, and attracts many antelope, mostly wandering in pairs.

My husband obtained the photograph given of one of the glaciers coming

down into the Lungmo Che on the right bank of the stream. Many of the seracs are seen to be isolated, standing on earth and stones. This may be a sign that the glacier is receding. If it once blocked the valley this might account for the fact that traces of human passage were found in valley J adjoining while none have been found in the Lungmo Che, in spite of its better grazing and similar direction.

Up to July 20 our weather had been on the whole good, though we had suffered from some sleet showers, and one night of snow (on July 16) with an east wind. Winds were generally high after midday until towards midnight, and the sky a good deal overcast, except during the early hours. Our minimum temperature since leaving the trade route had been 15° F. on July 17; maximum 62° F. Although we had not hitherto had any serious difficulties with rivers, after reading Major Mason's report for 1926 we expected that we should have to retrace our steps and get back to the trade route north of the Karakoram Pass. Ibrahim, the Karakash, who had been with Major Mason, did not know of any way across the hills from the Yarkand River valley to the trade route north of the Karakoram Pass, until the Khuffelang–Aktagh track was reached. This was two days' march northwards, down the river, below the Lungmo Che junction. He did not think we should be able to make Khuffelang, owing to the difficulty of fording the stream in summer-time and the enclosed nature of the gorge above Khuffelang. However, as we had had a good deal of cold sunless weather and the snows were late in melting everywhere that year, we thought there could be no harm in sending two men down to have a look. Ibrahim and another young Argon pony-man named Ghulam Hassan undertook to go downstream and see what our chances were of getting a caravan through. We struck our Lungmo Che camp on July 21 and marched downstream to the junction in the afternoon. On the way we met Ibrahim and Ghulam Hassan returning from their reconnaissance, and to our surprise they reported favourably on the state of the river.

The march down to Khuffelang took us two days from the Lungmo Che junction. On the first day we forded the Yarkand River near the junction, from the left bank to the right, at about 9 a.m., without difficulty. We found it best, however, to carry over our goats and sheep on pony-back. We continued down the right bank and camped at the first good grazing-place, about 9 or 10 miles down—a pleasant sheltered camp under the cliffs and near good grass and water. Some small wild duck were seen, also some Brahmini geese.

On the second day we forded the river three times, all between about 8 a.m. and midday, when the water is at its lowest. It begins to rise after midday. One ford was rather deep, but not too swift, and the ponies all kept their feet and brought their loads safely over, including sheep and goats on the saddle animals. In the gorge just above Khuffelang, between the second and third fordings, we met a caravan of Yarkandis pitched for grazing. To avoid the gorge *below* Khuffelang they had made their way over the hills from Kulan Uldi, and we gathered, through Ibrahim interpreting, that they had had a bad time and were glad of the rest and grazing for their beasts on the brushwood flats just above Khuffelang before going on.

We reached Khuffelang on July 23 about midday, and camped a few miles

Seracs of a glacier on south side of Lungmo Che (Valley I), tributary of Yarkand River from the west

Looking up Valley B towards source of Yarkand river

In the gorge above Khuffelang, Yarkand river

beyond it on the road to Ak-Tagh, which we followed the next day to its junction with the trade route. In Colonel Wood's report of his expedition he writes that on July 20 the water in the Yarkand River was so great that he did not think it advisable to try and follow it down farther than the junction of I and J valleys. (I valley is now called the Lungmo Che since Major Mason's expedition of 1926.) Colonel Wood succeeded in traversing this piece of the river valley in September 1914, however. Major Mason and those with him did not take that way. Our Ladakhis and the Yarkand pony-men told us that it was not a route used by traders, and that the water in the Yarkand River was always expected to be a difficult proposition in the summer months, especially in the gorge just above Khuffelang, where, should a sudden flood occur, it might be hard to extricate a caravan without loss. It may therefore be of interest to travellers in these parts to know that we were able in 1927 (considered a late year) to get down the Yarkand River from the junction of stream A to Khuffelang without difficulty during the month of July. The length of the journey from Chajos Jilga on the trade route to Chibra, again on the trade route, is approximately 114 miles, going this way by the Yarkand River to Khuffelang and through Ak-Tagh. By the ordinary trade route it is about 61 miles, scarcely more than half the distance. Yet the longer route has some advantages, provided the water conditions allow it. Our ponies kept notably fat and fit during the whole time of our deviation from the trade route. In spite of the longer time taken they seemed to be the gainers in condition, owing to the good grazing to be had in the Yarkand River valley. We also enjoyed having plenty of fuel, and were able to replenish our larder with antelope and wild duck easily enough.

One other point of interest is that we found many traces of yak droppings in the Yarkand River valley far above Khuffelang, and my husband also saw a bovine skull up in the hills. Colonel Wood tells me that he had a mixed transport of coolies, camels, and ponies in this region in 1914, but does not include yaks on the list. We were told that Major Mason's expedition in 1926 took ponies and not yaks. Traders are said never to pass that way. Were these traces (quite unmistakably bovine) left by wild yaks at any time, or by some yak caravan which has visited the place and left no other trace ?

In the gorge above Khuffelang, Yarkand river

Looking up Valley B towards source of Yarkand

THE TRIANGULATION OF NORTH AMERICA

WILLIAM BOWIE

CHIEF, DIVISION OF GEODESY, U.S. COAST AND GEODETIC SURVEY

FOR many years the triangulation of North America existed as a number of detached pieces. Most of the arcs have now been combined into a single system. In this respect the triangulation of North America has followed the usual method of development incident to this class of work. When the systematic survey of the coasts of the United States was begun about a hundred years ago, triangulation was extended from each of a number of astronomic stations located in strategic points. Whenever two or more of these separate coastal arcs were joined they were harmonized by a local adjustment, but much remained to be done before a single system could be formed for the whole country.

The United States Coast Survey, when first organized, had for its sole function the location of the coast-line and the execution of surveys necessary for the production of hydrographic charts. To serve as control for these coastal surveys, an arc of first-order triangulation was extended from Maine to Delaware Bay along the coast and thence south-westward along the foothills of the Appalachian Mountains to Mobile, Alabama; and on the Pacific coast an arc of first-order triangulation was extended from the 40th parallel southward to the Mexican Boundary.

It was early realized that the coasts of the Atlantic and Pacific oceans and the Gulf of Mexico should be joined by a transcontinental arc of triangulation in order to secure their proper coordination. This was accomplished by the execution of an arc of first-order triangulation along the 39th parallel of latitude extending from the Atlantic to the Pacific. Field work on this arc was begun in 1871 and finished in 1896. While this work was in progress the interior triangulation was found to be of such great value for many purposes other than the coordination of the coastal charts that the Coast Survey was charged by the federal government with the execution of geodetic surveys throughout the interior of the country, and the name of the bureau was changed in 1873 to Coast and Geodetic Survey.

In making the interior surveys the Coast and Geodetic Survey was assisted in the north-eastern part of the country by an organization called the Lake Survey, a branch of the Corps of Engineers of the United States Army, which was directed by Congress to chart the Great Lakes along the boundary between Canada and the United States. That organization executed a system of first-order triangulation extending from the eastern end of Lake Ontario to the western extremity of Lake Superior, and also ran an arc overland from the western end of Lake Erie to the southern extremity of Lake Michigan, and another from Lake Michigan through Eastern Illinois to a connection with the transcontinental arc along the 39th parallel.

The next great arc of first-order triangulation was started in the late '90's by the Coast and Geodetic Survey and completed in 1916. It extends along the 98th meridian from the mouth of the Rio Grande, latitude 26°, to the Canadian Boundary, latitude 49°. As explained later, this arc has also been carried through Mexico by the geodetic organization of that country, and in

addition to its ordinary uses forms a very valuable arc for figure-of-the-Earth determinations.

Upon the completion of the 39th parallel triangulation across the United States the time seemed opportune to unify the various arcs of triangulation of the United States in order to place them on a single spheroid and compute and adjust them in reference to a single station. After a careful analysis of the agreements and disagreements of the geodetic and astronomic longitudes and latitudes at many stations of the existing triangulation, the late Dr. John F. Hayford, then in charge of the geodetic work of the United States, selected a longitude and latitude for a triangulation station called Meades Ranch, in Kansas near the geographical centre of the United States. The coordinates thus selected approached the ideal datum which would make the sum of the squares of the differences between the astronomic and the geodetic latitudes and longitudes a minimum. A slight departure was made from the ideal, since it was found that the triangulation on what had been called the New England Datum agreed very closely with the ideal and it was possible to avoid the necessity of computing and readjusting a large section of the existing triangulation of the country. This slight change was not important, for the later addition of any new arcs of triangulation to the scheme would be sure to change slightly the ideal latitude and longitude for the initial station.

In selecting a datum for the United States Hayford decided that the Clarke spheroid of 1866, as expressed in meters, which had been used for many years by the U.S. Coast and Geodetic Survey for its triangulation, was the most practicable one for the new datum. His recommendation was approved by Dr. O. H. Tittmann, at that time Superintendent of the Survey. The geographic position for Meades Ranch, the azimuth of a line from that station to station Waldo, and the Clarke spheroid of 1866 as expressed in meters, were adopted in 1902 and called the United States Standard Datum. In 1913 this same datum was adopted by Canada and Mexico, and the designation was then changed to that of the North American Datum, on account of its international character.

Since the adoption of the datum many additional arcs of triangulation have been run in the United States. There are now 25,000 miles of arcs of first-order triangulation in this country, mostly in the interior. In addition to this first-order work there is considerable triangulation along the coasts and in the interior of the country of lower orders of accuracy. For example, the triangulation along the Atlantic coast from Cape May, New Jersey, southward and along the coast of the Gulf of Mexico, is of third-order accuracy. The triangulation along the Pacific Coast from the vicinity of San Francisco to the Straits of San Juan de Fuca, in north-western Washington, is partly of third-order and partly of second-order accuracy. The existing first-order triangulation of the United States is shown in black bands on Fig. 1.

In explanation of the different grades of work just mentioned, it should be stated that first-order triangulation is that in which the average closing error of a triangle is about 1 second, with a maximum closing error seldom exceeding 3 seconds; second-order triangulation is that in which the closing error is about 3 seconds, with a maximum seldom exceeding 5 seconds; and third-order triangulation is that in which the average closing error does not exceed

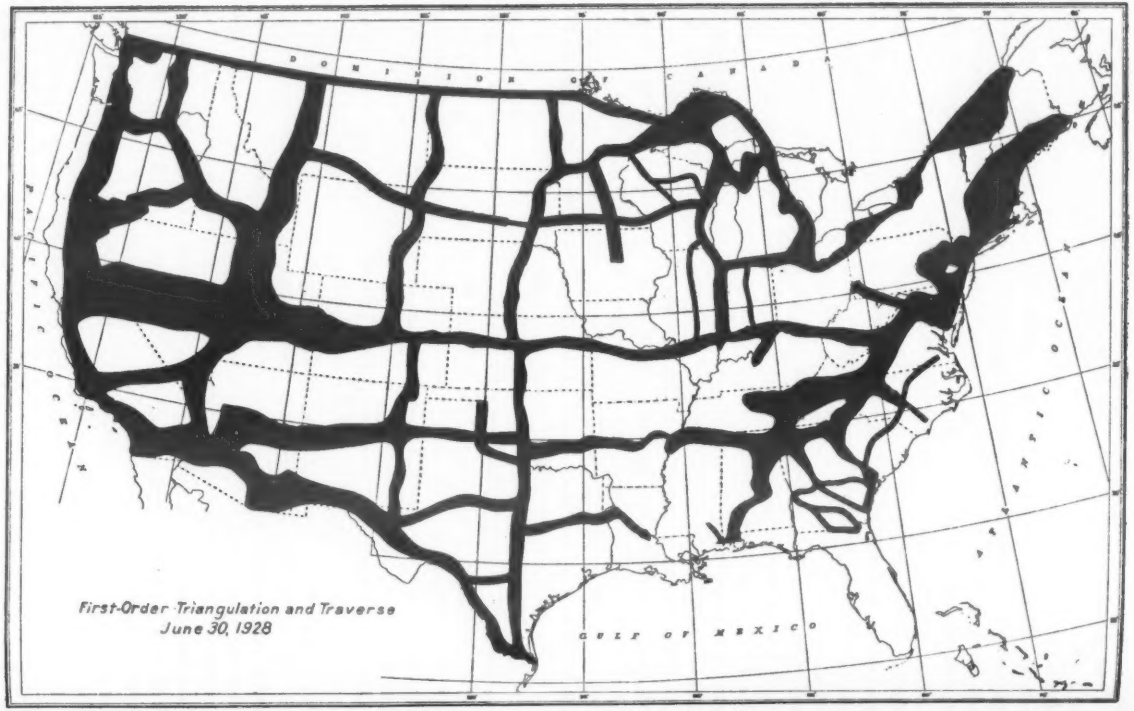
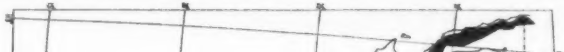


Fig. 1. First-order triangulation of the United States



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5 seconds, with a maximum not often greater than 10 seconds.* In the specifications for these grades of triangulation provision is made for base lines at such intervals as may be necessary to control the lengths of the triangle sides. It is probable that, in the future, second-order triangulation will be extended along those portions of the coast of the United States where the existing triangulation is of the third order, and that this coast triangulation will be connected at frequent intervals with the first-order triangulation system of the interior of the country.

The triangulation of Mexico is shown in Fig. 2. It has been executed by

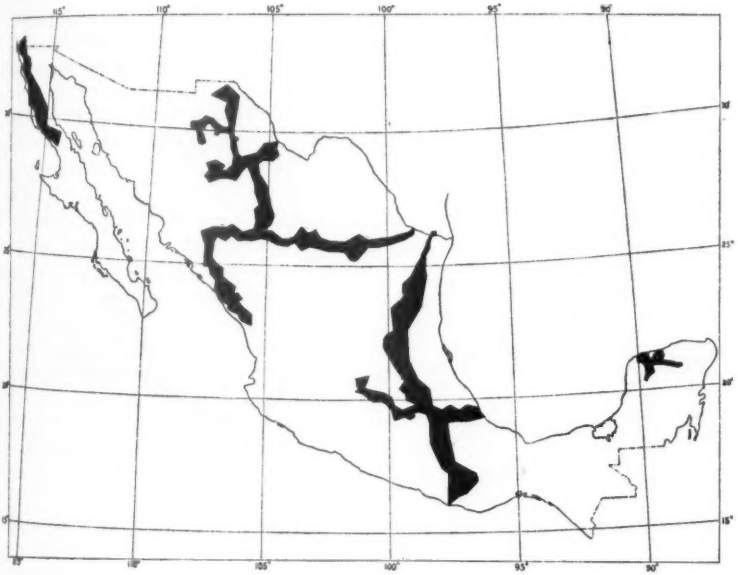


Fig. 2. The triangulation of Mexico

the geodetic organization of that country, formerly called the Mexican Geodetic Commission and now named the "Dirección de Estudios Geográficos y Climatológicos." For more than a decade the operations of that bureau have been under the charge of the Director, Prof. Pedro C. Sánchez, Tacubuya, D.F., Mexico.

The triangulation of Mexico is connected with that of the United States near the mouth of the Rio Grande and also along the boundary between California and Lower California. The 98th meridian connection was made in 1913 and the other in 1919. It is probable that another connection between the two systems will be made within the next year in the vicinity of Ciudad Juarez and El Paso in approximate longitude 106° 30′. Most of the work

*It should be noted that the specifications for second and third order triangulation are more stringent than in British practice.—Ed. *G.J.*

Fig. 1. First-order triangulation of the United States

shown in Fig. 2 is of first-order accuracy and forms an excellent control system for the mapping of Mexico.

The first-order triangulation of Canada is shown in Fig. 3. The geodetic work of that country is done by the Geodetic Survey of Canada, Ottawa, whose director is Mr. Noel J. Ogilvie. For many years the Canadian triangulation existed only in the eastern part of the country, in the provinces of Quebec and Ontario. The figure shows that the triangulation is now widespread and extends from the Atlantic to the Pacific Coast. The triangulation systems of Canada and of the United States have many points of contact, as there is an arc of first-order accuracy extending along the whole boundary from the Atlantic to the Pacific. The part of this arc which extends from Lake Superior along the boundary to Point Roberts, the western extremity of the land boundary between the United States and Canada, was executed by coopera-

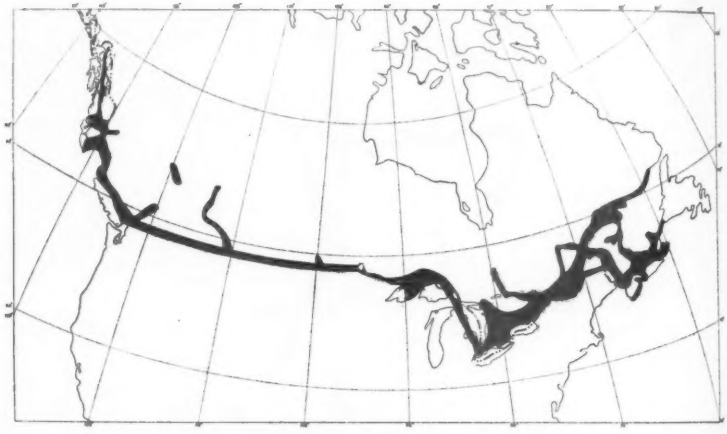


Fig. 3. First-order triangulation of Canada

tion between the Geodetic Survey of Canada and the U.S. Coast and Geodetic Survey. The part near the boundary to the east of Lake Ontario was executed by the Geodetic Survey of Canada, and, as mentioned earlier, the arc along the Great Lakes was done by the Lake Survey.

The Geodetic Survey of Canada and the United States Coast and Geodetic Survey have also cooperated in the extension of a first-order arc from the vicinity of Point Roberts, northward along the coast of British Columbia to Dixon Entrance, Alaska, and thence to the head of Lynn Canal and Skagway. This triangulation is also shown in Fig. 3. Further cooperation is planned in extending this arc into north-western Canada and Alaska. The Geodetic Survey of Canada will work from the vicinity of Skagway northward to the Yukon River, thence down the river to the 141st meridian, the boundary between Alaska and Canada. From there the Coast and Geodetic Survey will extend arcs into Alaska for the purpose of coordinating the charts of the coast and for the control of the surveying and mapping activities in the interior.

It is hoped that before very long the first-order triangulation of North America will be extended to the Arctic Ocean through both Canada and Alaska. When this is done, there will be continuous first-order triangulation from latitude 70° to latitude 16° in Southern Mexico. The triangulation in Mexico may eventually be carried southward through Central America, the Isthmus of Panama, and on into South America to join with the triangulation systems of the countries of that continent.

There has been a gradual development in triangulation instruments and methods since the first work was done in North America 112 years ago. At first base lines were measured with bars, which required a moderately level terrain as well as much time and effort. Now they are measured with invar tapes or wires, and the measurements are made in daylight over fairly uneven ground. No Laplace* azimuths were used prior to 1907. Laplace stations are now easily established and are used extensively to control the triangulation in azimuth. Prior to the beginning of the present century the observers strove to secure the longest lines possible, in order to reduce the number of base lines necessary for an arc, and to secure the least swerving of the arc in azimuth as the work progressed. Bases are now measured rather close together, and the lines of the triangulation are made of more moderate length in order that local surveys and other engineering operations may be easily tied into the triangulation, thus making it of greater geographic value. The attempt is always made to keep the total cost of an arc a minimum. In mountainous country costs are reduced by using lines from 40 to 60 miles in length. These lines can be observed without difficulty, whereas observations over lines 80 to 100 miles long may often be prevented by haze or smoke in the atmosphere.

In the earliest triangulation of the Coast and Geodetic Survey heliotropes were used in conjunction with poles and targets. From time to time experiments were made with lamps, as it was realized that observing conditions at night are nearly always more favourable than even the best parts of the day. Besides, a lamp can be used for many hours of observing, but it is impossible to use heliotropes on cloudy days, and on clear days two or three hours in the late afternoon are the only suitable ones for daylight observing. No great success was obtained with the lamps however until the introduction of the acetylene lamp. The first acetylene lamps used on triangulation were bicycle acetylene lamps combined with condenser lenses. These proved quite satisfactory on the 98th meridian triangulation during the season of 1902. Later the automobile headlight acetylene lamp was employed. Since 1916 the automobile electric headlight with special concentrated filament lamps have been used in the triangulation of the United States.

In the early days lumber was plentiful and cheap and wooden towers were used in the comparatively level country where the curvature of the Earth, buildings, and trees make it necessary to elevate the theodolite, lamp, and heliotrope to clear the line of sight between contiguous stations. Since the World War the cost of lumber has been so great in the United States as to

*A Laplace station is a triangulation station at which the astronomic longitude and azimuth have been observed. With the data secured the tilt or deflection of the plumb-line can be determined, and then the observed azimuth is corrected for the deflection.

make the building of high wooden signals very costly. In order to obviate this difficulty a steel tower was designed and constructed in the early part of 1927, which was used at ninety-six triangulation stations in Minnesota during the following summer, on arcs totalling 475 miles in length. These towers, called the "Bilby Towers" after their designer, are about 75 feet high to the head of the tripod and cost slightly less than $300 each. They can be used for many seasons, since they are easily erected and taken down with no injury (except in very rare cases) to any of the parts. Even if some part of either the inner or outer tripod is injured it can easily be replaced by securing a substitute piece from the manufacturer or by having a duplicate made in a machine shop.

It was found in some cases that the 75-feet tower was not of sufficient height to raise the instrument above intervening groves of trees, and hence, during the season of 1928, an extra section of 13 feet will be added to the height of the towers, making the new height to the tripod head nearly 90 feet.

About twenty years ago it was noticed that arcs of triangulation, for which observations were made largely in daylight, tended to swerve from their true directions. The exact cause of this has not been discovered, but it was probably due to unequal heating of the theodolite, in spite of the fact that the instrument was shielded from the direct rays of the sun during observations. The experiment was tried of making all of the observations at night on several arcs, with no main scheme daylight observations whatever. This seemed to eliminate almost entirely the swerving of the triangulation and the Coast and Geodetic Survey has made it a practice since then to make all of its main scheme observations for first-order triangulation at night. The writer understands that both Canada and Mexico are also doing most of their observing at night with the aid of electric signal lights.

A very important part of triangulation surveys is the proper marking of the stations. Canada, Mexico, and the United States are all monumenting their triangulation stations with metal markers set into heavy blocks of concrete or into outcropping rock.

The Coast and Geodetic Survey is planning to expand its first-order triangulation until no place in the country will be more than about 50 miles from a first-order station. The arcs will be spaced approximately 100 miles apart and will be connected by cross arcs at frequent intervals. The spaces between the first-order arcs will be traversed by arcs of second-order triangulation which will provide that no place will be more than about 25 miles from a first- or second-order station. The remaining spaces will finally be covered by third-order triangulation during the topographic, political boundary, and property surveys that will be made by the United States Government or by officials of states, cities, and counties.

When the triangulation of the United States had progressed to a certain point, it was found to be increasingly difficult to adjust new arcs of triangulation into the old network. This was inevitable, for all of a loop closure would necessarily have to be applied to the new arc, which constituted only a small section of the loop. This difficulty led to a study of methods for adjusting a large network of triangulation with a view to finding one that might be used in the United States of America. No practicable, previously employed, method was found which could be applied to so large a net of triangulation

involving many thousands of miles of arcs. As a result of the studies, however, a new method was devised, and this method has been successfully employed in adjusting about 13,000 miles of arcs of triangulation comprising all of the first-order triangulation of the United States from the 98th meridian westward to the Pacific Ocean. The readjustment of this triangulation required the time of about twelve mathematicians for an average of fifteen months.

The first result obtained by the readjustment was the most probable value for the geographic position of a selected triangulation station at each of the junction points of the several arcs in the net. With these positions known, it has been a simple matter to adjust the sections of the arcs lying between the

Fig. 4. Arcs and closing errors in Western United States

junction points. This has now been done for all of the triangulation of the western half of the United States. Using the geographic positions of certain triangulation stations in the vicinity of Point Roberts in the north-western corner of the United States furnished by this adjustment the Geodetic Survey of Canada has adjusted the arc extending through British Columbia. Computations have been completed for the first-order arc extending from Dixon Entrance through South-Eastern Alaska to Skagway.

Fig. 4 shows in bare outline the positions of the several arcs of the western half of the country and the closing errors of the several loops. The closing error is given first in feet, then as a ratio of the closing error to the distance around the loop.

It is hoped that within the next two or three years the network of triangulation of the eastern half of the United States will be expanded to such an extent

that a readjustment of it can be made by the new method. It is planned to use the combined nets of eastern United States and of Eastern Canada in that adjustment. It cannot be foreseen how much this new eastern adjustment will change the old geographic positions, but even though the changes may not be sufficient to justify a recomputation of the whole triangulation for geographical and engineering purposes, the new values at the junction points will be useful for scientific purposes.

It is expected that no change will ever be made, for geographical and engineering purposes, from the Clarke spheroid of 1866 as expressed in meters which was adopted in 1902, but officials of the Coast and Geodetic Survey plan to have at least the junction points of the triangulation net of the United States referred to the Hayford international spheroid in order that the results may be available for new determinations of the figure of the Earth.

In conclusion, the writer wishes to express his great pleasure at the happy results which have been secured for the continent of North America by the cooperation of the Geodetic Survey of Canada, the Department of Geological and Climatological Research of Mexico, and the U.S. Coast and Geodetic Survey. The officials of the geodetic organizations of those three countries have considered North America as a single unit in the extension of their triangulation. Each organization cares for that part of the work within its own political boundaries and cooperates with the other two nations to make the triangulation net of the entire continent a harmonious whole. The writer feels certain that this cooperation will continue indefinitely, and that there will be unified systems for all branches of geodetic work from the most southerly point of Mexico to the Arctic Ocean.

THE ARIDITY OF THE TURFAN AREA

LIEUT.-COL. R. C. F. SCHOMBERG

IN recent years much has been written about the desiccation of Chinese Turkistan, that vast region, largely desert, that lies between the Tien Shan in the north and the Kun Lun in the south. Learned explorers have been at pains to prove that the climate of this area has changed, and is changing, and that a process of drying up, in recent times, has taken place. Whether a change in the climate has taken place in the Tarim basin proper, within say the last fifteen hundred, or even a thousand years, is a very attractive subject for research. A recent visit to what may be called a subsidiary part of the Tarim basin showed certain signs that climatic changes of recent years—once again be it understood in historical times—could not with certainty be ascribed to diminished rainfall and atmospheric aridity.

The argument for desiccation is, it appears, that less snow, less water, and so less vegetation has been the sequence in Chinese Turkistan. The area under review is the Turfan district, a depression much below sea-level in certain parts. It has been argued that this tract of country supported a much greater population than it does now, and that the whole depression is much drier, and consequently less fertile, than it used to be : and that these changes are attributable to an altering climate.

Explorations in Turfan have brought to light many evidences of its former prosperity. Documents in many languages show that it was much frequented, and that its population was much larger than could now be supported. But did it in those days feed this population ? Lying as it then did, at the meeting-place of the chief routes in this part of Asia, it collected a large and mongrel mass of inhabitants whom the facilities for trade attracted. But it is doubtful if for that reason the town fed itself. A large population was no more a proof of agricultural fertility a thousand years ago than it is to-day. Transport in Central Asia, at any rate Chinese Central Asia, remains the same as it was ten centuries ago; and the towns of Qara Shahr, Kurla, and Urumchi can no more feed themselves to-day than Turfan could in the past.

Indeed, observation of the Turfan depression points to the fact that it probably supports now a larger population than it ever did—although it grows cotton, which has to be bartered for cereals—and that the water is as abundant as ever it was. There are numerous beds of dry reeds, reeds which have perished many years ago, but what killed them was the deviation of the water for agricultural purposes. Near Turfan City several Karez, full of water, flowed beneath these buried stretches of dead reed; and at Murtukh the peasants were in February digging up the reeds to plant with maize the recovered ground.

Old ruins, abandoned houses, and the like, which abound throughout the depression are no index in Asia of an erst-while fertility. War, pestilence, and famine have rather been their downfall than any act of Nature. When a city has been destroyed by war, it is much easier for the timid peasants who creep back after the conquerors have gone, to start tilling new ground than to begin to clear away the heavy débris of ruined mud walls and fallen rafters.

Indeed, the ruined sites of Turfan appeared to bear no evidence of a

slowly drying and perishing land. At Qarakhoja the large walled city was side by side with the prosperous settlement of to-day, and inside its crumbling walls every clear or level space had been ploughed for the spring sowing. The large mass of ruins, 5 miles from Turfan city, stand on a high and crumbling promontory of loess. On both sides are abundant streams, and the valleys are thick with trees, and the houses and fields are eloquent of flourishing civilization. The city was doubtless supplied with water by a conduit in the days of its prosperity. But no sensible man would endeavour to cultivate it to-day, for the removal of the maze of mud and rubbish is well-nigh impossible.

On the south of the depression are the old remains of Chong Hassar and Kichik Hassar. One would appear to have been a fortress. The latter was a Buddhist stupa. When visited, the weather was perfect. It was a brilliant day in late winter. Chong Hassar was tenanted by a shepherd whose flocks were grazing on the surrounding herbage. There was abundant water about, and from the general aspect of the landscape, there was no evidence of either former cultivation or present desiccation. The fortress was built for protection: the monastery or stupa for seclusion. Indeed, it was remarkable in the district how old sites and new ones were intermingled—an indication that the water of one thousand years ago is still present.

Some of the finest trees in the plains of Turkistan were the willows along the Sengim road. They were as fine as well-grown English oaks, and the only ones that can compare with them are those at Bugur, between Kucha and Kurla. At Sengim, too, were old reeds, dead and desiccated. The same old reeds that are dug for fuel; but it was noteworthy that a new and vigorous growth of reeds was springing up side by side with their predecessors of bygone days.

It seems that a changing climate has been blamed for desiccation. But the alteration in the distribution of water seems a reasonable and equally plausible cause—always excepting political consequences, and the destruction and spoliation of the land by the victors, which has ever been the cause of ruined cities and ruined land in most parts of Asia.

It may be recalled that in India, particularly in the Southern Punjab and in Sind-Rajputana, whole rivers have vanished or have changed their course, yet this cannot be ascribed to alterations of climate.

Mr. Douglas Carruthers in his admirable work, 'Unknown Mongolia'—a book whose fault is that it is far too brief—describes (vol 2, pp.458 *et seq.*) the desiccation in actual progress at the small settlement of Chi Ku Ching on the Hami–Urumchi road, immediately south of the eastern ranges of the Tien-Shan.

Since he visited this place a large Karez has been built. It flowed well for seven years, but then the lower or Chi Ku Ching end subsided. Consequently the water only flows at the farther extremity, where it is no use. Karez want to be regularly cleaned out. As the inhabitants of this miserable dusty little hamlet are not agriculturalists but live by swindling travellers, they were not interested in the success of the Karez. It was built by forced labour; and as there was no corvée to keep it in repair, it collapsed.

Chi Ku Ching is now three times the size it was when Mr. Carruthers

visited it. There is, however, abundant water 12 to 15 feet below the surface. Whatever desiccation is in progress, the cause must be a defect in the water, not the climate. The tamarisk mounds, cut away by æolian action and showing their dead layers of brittle root, are much in evidence, but it was interesting to note that by the side of these dead mounds there were also, in some cases but by no means in all, mounds covered with a vigorous growth of the living plant.

Undoubtedly in the Turfan depression, in the Tarim basin, and elsewhere areas are drying up, but it is suggested that the causes of this desiccation may perhaps be due to the failure of—not, be it noted, a lack in—the water supply. Subsidence below the surface, the blocking of some spring by rock, the tapping of the source elsewhere appear to be reasonable explanations. A change of climate in historical times would surely show itself more widely and more convincingly.

The great feature of Turfan to-day is the Karez. The whole district is dotted with the mounds that mark these subterranean watercourses. It is to these Karez, of comparatively modern introduction—say two centuries old—that Turfan owes its present prosperity. And their presence is proof that there is abundant water, now more skilfully used than before, in the area. What is more, tracts of land never before cultivated are being brought under the plough. All this points to no diminution in the water supply; and hardly supports the theory of a change, in modern times, in the climate.

Unquestionably Turfan is a hard land compared with the easy agricultural conditions of the southern parts of the province, where the water comes of its own free will wherever the cultivator wishes.

Here, in the Turfan district, the water has to be won with labour from under the earth, and the aspect of the country generally, as well as the conditions of tillage, crops, trees. etc., remind one of parts of the Punjab or North-West Frontier. The comparison is heightened by the range of rugged mountains to the north, glistening with snow, precisely as the Himalayas appear on a late winter's day from many parts of Northern India.

It does seem, however, that the theory of recent climatic changes in this depression should be regarded as open to some modification and amendment.

THE OFFICIAL ROMANIZATION OF JAPANESE

J. H. REYNOLDS

SECRETARY, P.C.G.N.

THE first of the Rules for the Spelling of Geographical Names for British Official Use, termed the R.G.S. II System, lays down that the spelling of every place-name in an independent country using the Latin alphabet shall be that adopted by the country. Japan has been regarded as coming under this head, as it produces official maps, etc. in Latin characters; and up till a few years ago there was little difficulty in determining the spelling of Japanese names, as one system of romanization, termed the Hepburn system, was in general use both in Japan and in this country. Divergencies from the original system may be found, notably the use of *zu* for the *dzu* of Hepburn's Dictionary, of *ae*, *ie*, *ue* for *aye*, *iye*, *uye*, of *kyo* for *kio*, while differences in local pronunciation may account for the interchange of *k* and *kw*, of *g* and *ng*. But these differences are slight compared with the recent innovations of the Nippon Romazikwai (Roman Letter Association of Japan).

Three sheets of the International Map have so far been produced by Japan, namely *Tokyo* 1917, *Osaka* (to the west of *Tokyo*) 1923, and *Kanazawa* (to the north of *Osaka*) 1927. These have been published by the Land Survey Department, which has also published a map of the Japanese Empire on the scale of 1 : 2,000,000 (1926). A glance at the names on these sheets reveals spellings of a novel, not to say revolutionary, character. If they are compared with the spellings on the old Topographical Map of Japan on the scale of 1 : 1,000,000 published by the Imperial Geological Survey, which had previously been the map-maker's standard for official spelling in Latin characters, such wide differences will be noticed that in some cases the names can hardly be recognized as being identical. Some examples will be given presently. It may be remarked that the Imperial Geological Survey continues to publish maps with the old spelling, which is also found in the *Official Guide to Eastern Asia* prepared by the Government Railways.

In October of last year a letter was sent from the Permanent Committee on Geographical Names to H.E. The Japanese Ambassador (i) calling attention to these differences of spelling in official Japanese publications; (ii) enquiring if the new spelling had been sanctioned by the Government for general use or whether the system of romanization employed merely reflected the opinion of the individual official responsible in the department concerned; and (iii), if the latter were the case, emphasizing the desirability of fixing one official form of romanization, preferably the long-established form known as the Hepburn system, the abolition of which would cause great confusion in all scientific and commercial circles. After referring the matter to Tokyo, the Embassy replied in May of this year in the following terms:

"There are in Japan two styles of Roman characters in general use in writing Japanese sounds, the Hepburn and the Nippon Romazikwai (Roman Letter Association of Japan) styles. While the former has a history of long usage, the latter claims to be an improved form. In fact, each style has its merits and demerits, and neither of the two can adequately express Japanese pronunciation. Thus, it is not easy to decide which is to be adopted ex-

clusively for official purposes, and the matter has been left to the departments concerned. . . . The differences between the two systems, of course, are not many and they are shown in the accompanying table." Then follows a list of fourteen syllables—a fifteenth seems to be omitted—in which a difference of spelling is involved.

The letter describes these differences as "not many." Now, it has been pointed out that these fourteen syllables are some of the commonest out of the total number, variously estimated as 47 and 72, on which the Japanese language is built up. It would be fair to say that at least one-fifth of the total number of Japanese syllables are involved. Further, it may be remarked that in nine out of the fourteen syllables a difference of initial letter is involved.

The Embassy's letter also states that neither system can adequately express Japanese pronunciation. This is likely enough; but, unless the new Romazikwai system is definitely nearer to achieving this object, it is difficult to see the advantage of abandoning spellings that have admittedly a history of long usage. And it seems fairly obvious that the new Romazikwai system makes no attempt to represent the pronunciation more closely. It was invented by an association of purists and is said to be regarded generally as somewhat pedantic in Japan and to have made very little headway there. A good authority has stated that it is practically never found in ordinary usage; the railways, post office, newspapers, and diplomatic circles use the old Hepburn system almost, if not quite, exclusively. Unfortunately, the authorities in the Land Survey Department and also in the Admiralty have come under the influence of the Roman Letter Association and issue maps and charts with the new spellings. It is said that the Imperial Japanese Government carries on its official business in more or less watertight compartments, and that there is little facility for coordination in a matter of this kind. There is certainly no indication in the Embassy's letter of any proposal to secure uniformity of spelling in official circles. The Government, in fact, seems to be somewhat indifferent about the matter and hardly realizes the great inconvenience that has been caused to foreigners by the introduction of a new system of spelling in official maps. These maps are naturally followed by map-makers abroad, and the names on their maps are copied by the press and public generally, though persons who do not refer to new maps will probably continue to use the old forms according to the Hepburn system. There seems, therefore, to be a good case for some concerted action in the direction of an attempt to persuade the Imperial Japanese Government to give a definite ruling on the official system of romanization—if possible, in favour of the Hepburn system.

The changes in orthography may be shortly enumerated and explained thus. In the Japanese language are found the syllables *ha, he, hi, ho;* but it is a peculiarity of Japanese to pronounce the corresponding syllable with the vowel *u* approximately as *fu* and not *hu*. Consequently *fu* is the spelling of the old Hepburn system; but the purists who invented the Nippon Romazikwai system wish to write *hu*. Similarly there are in Japanese the syllables *ta, te, to;* but the corresponding syllables with the vowels *i* and *u* are pronounced respectively *chi* and not *ti*, *tsu* and not *tu*. The new system writes *ti* and *tu* where the old system wrote *chi* and *tsu*. The principle is extended by the Nippon Romazikwai system to syllables with the palatal vowels *ya, yo, yu;*

thus, the new system writes *tya, tyo, tyu, sya, syo, syu, zya, zyo, zyu* where the old system wrote *cha, cho, chu, sha, sho, shu, ja, jo, ju*. The Hepburn *ji* becomes either *zi* or *di*, and the Hepburn *dxu* becomes either *zu* or *du* in Nippon Romazikwai; *zu*, which is not found in Hepburn's Dictionary, certainly does occur—for example, in the old Topographical Map and in the Official Guide Book; but it is then represented in Nippon Romazikwai by *du*. If we add that the Hepburn *shi* becomes *si* in the Nippon Romazikwai system, we have accounted for fifteen syllables, where differences of spelling occur.

Finally, there is a small but rather irritating innovation of another kind, namely, the substitution of the circumflex accent ^ for the long sign ¯; *e.g.* Tôkyô. Before the invention of the Nippon Romazikwai system the long sign was almost universally used; it is found, together with the rest of the Hepburn system, in so recent a publication as the great work on *Japanese Names and How to Read Them* by A. J. Koop and Hogitarō Inada (1923). The following few examples, which could be multiplied indefinitely, are taken from the published sheets of the International Map and are compared with the spellings on the old Topographical Map of the Imperial Geological Survey. The last two are also well-known personal names.

International Map. Land Survey Department.	*Topographical Map. Imperial Geological Survey.*
HUZISAN	FUJISAN
HATIOZI	HACHIOJI
TYÔZYA	CHŌJA
SYÔDOSIMA	SHŌDOSHIMA
TU	TSU
HUTYÛ	FUCHŪ
ZYÔHANA	JŌHANA
TITIBU	CHICHIBU
SIMIDU	SHIMIZU (Hepburn -DZU)

These considerations were brought to the notice of the Japanese Delegates at this year's International Map Conference held at the house of the Royal Geographical Society; and on July 16 the following Resolution was passed:

"The Conference on the International Map of the World, assembled at the Royal Geographical Society, London, suggests to Professor Naomasa Yamasaki, Delegate of the Japanese Government, that his Government should be approached with the request that one official form of romanization of Japanese place-names may be adopted."

SPELLING OF CERTAIN JAPANESE SYLLABLES: NIPPON ROMAZIKWAI SYSTEM

The orthography according to the Hepburn system (and to the approximate pronunciation), where differing from the Nippon Romazikwai system, is given in brackets. In the remaining syllables, given for completeness, there is no difference in the orthography of the two systems.

HA	HE	HI		HO	HU (FU)					
SA	SE	SI (SHI)		SO	SU		SYA (SHA)		SYO (SHO)	SYU (SHU)
TA	TE	TI (CHI)		TO	TU (TSU)		TYA (CHA)		TYO (CHO)	TYU (CHU)
ZA	ZE	ZI (JI)		ZO	ZU (DZU)		ZYA (JA)		ZYO (JO)	ZYU (JU)
DA	DE	DI (JI)		DO	DU (DZU)		DYA (JA)		DYO (JO)	DYU (JU)

THE INTERNATIONAL MAP CONFERENCE, LONDON, 1928

IT was arranged that the International Map Conference of 1928 should be held in London immediately before the meeting of the International Geographical Congress at Cambridge. Two meetings of the Commission de la Carte du Monde au Millionième accordingly took place in the map-room of the Royal Geographical Society on Saturday July 14 at 10.30 a.m., and on Monday July 16 at 3.0 p.m. General Nicola Vacchelli, President of the International Geographical Union, was in the Chair, and the following Delegates were present: *Afghanistan*, M. M. Yunus; *République Argentine*, Major D. Baldomero de Biedma, Don Floris Jansen; *Belgique*, Col. J. Maury; *Canada*, Major G. G. Aitken; *Égypte*, Hussein Sirry Bey; *Espagne*, Don Manuel de Cifuentes, Don Lorenzo Ortiz; *États Unis*, Col. C. H. Birdseye, Dr. Isaiah Bowman, Mr. S. W. Boggs, Col. E. Lester-Jones; *Finlande*, H.E. A. H. Saastamoinen; *France*, Général A. Bellot, Général R. Bourgeois, Prof. E. de Margerie, Col. P. Penel; *Grande Bretagne*, Col. Sir Charles Close, Rear-Adm. H. P. Douglas, Mr. A. R. Hinks, Major D. A. Hutchison (Secretary of the Central Bureau), Brigadier E. M. Jack (Director of the Central Bureau), Col. H. S. L. Winterbotham; *Inde*, Lieut.-Col. C. M. Browne, Lieut.-Col. R. H. Thomas; *Irlande*, Mr. G. H. Mew; *Italie*, Cav. F. de Filippi; *Japon*, Col. E. Ishii, Capt. Tachibana, Prof. N. Yamasaki; *Pologne*, Lieut. S. Pietkiewicz, Prof. E. Romer; *Tchécoslovaquie*, Gen. C. Rausch; *Venezuela*, Don F. J. Duarte. On Monday H.E. The Austrian Minister attended the Conference.

Saturday morning was occupied with the consideration of proposals put forward by the British Delegates as representing the fruits of preliminary inquiries and correspondence conducted by the Central Bureau. The following is the Report presented to the International Geographical Congress:

In reply to the question concerning the Carte du Monde au Millionième raised at the Geographical Congress at Cairo in 1925, I have to report that a Commission under the presidency of General Nicola Vacchelli met at the Royal Geographical Society's House, London, on Saturday July 14, and that an agreement was reached on all points.

The questions raised together with the resolutions passed were as follows:

A. General Questions:

1. *Improvement of the arrangements for sale and distribution of the International Map.*

A resolution was passed that each delegate should endeavour to obtain the name of at least one agent in the country represented by him and to report the name to the Secretary of the Central Bureau.

In connection with this the Central Bureau pointed out that many countries have already taken such action, but that there still remain many that have not. The Central Bureau proposes to publish a special list of those agencies for circulation to all concerned. With regard to the price of sheets, a resolution was passed that:

> "Provisionally the price of each sheet for sale outside the country of origin shall be fixed at three shillings or its equivalent, with discount to the trade of one-third."

2. *Financial arrangements for the support of the Bureau.*

The Commission proposes that the Governments of the countries adhering

to the Carte du Monde be asked to sanction the fixing of the subscription to the Central Bureau at £10 sterling or its equivalent.

B. Technical:

1. *Preparation of more definite regulations regarding the production of Provisional Editions.*

With regard to section 7 d, which states:

"In parts not completely surveyed, the relief may be shown by broken contours, by shading, or by hachures according to the degree of accuracy of the data available. A sheet so compiled shall be marked 'Provisional Edition.' No system of relief shall be used, if the information is not sufficient to justify it."

The Commission agreed that the above should be cancelled and the following substituted:

"All sheets of the International Map that are published in the future shall conform to the agreed conventions.

"The degree of reliability of the information given on the map shall be indicated when necessary by a diagram in the margin."

2. *Criticism of existing regulations in respect to:*

(*a*) *The system of sheet lines.*
(*b*) *Conventional signs.*
(*c*) *Selection of names.*

(*a*) With regard to system of sheet lines, it was agreed that in future sheets which depart from the regular sheet lines shall not be recognized as forming part of the International Series, except that in certain cases an extension of a sheet may be permitted. But in any case the corners of the regular sheets should be indicated.

(*b*) *Conventional Signs.*

It was generally agreed that changes in the existing conventional signs should be discouraged. At the same time certain existing signs have been found inconvenient and new conditions require the addition of new signs.

The following resolutions were passed and Section 10 will be amended accordingly:

1. That, without altering the signs for roads, the office issuing a sheet should explain in the legend what is meant by a main road, etc. (*i.e.* "Fit for heavy motor transport," "Light motor transport," etc.).

2. That, as the sign for Forests and Woods is generally agreed to be unsuitable and is never used, it be removed from the Conventional Sign Sheet.

It should be pointed out that Section 10 j lays down that the symbols on the accepted conventional signs sheet must be used for the features that they represent. The cancellation of the Forest symbol will enable a country to design a suitable symbol for its own use provided a description is given in the margin. It does not mean that forests and other surface features are never to be depicted.

3. That, as the existing signs for the International and other boundaries are cumbersome and inconvenient, new signs be adopted.

4. That, as the existing sign for a Wireless Station is liable to be confused with Telegraph Station, a new sign be adopted.

5. That new signs be adopted for the following:

Oil Wells	Aerodrome with hangar
Tunnel	Landing ground for Aeroplanes
Railway Station	Airship Station

C. Selection of Names.

It was agreed that the question of names must be left to the discretion of the office producing the sheet.

Patterns of the new signs proposed were provisionally adopted, and their ultimate forms will be given in the official report of the Conference.

On Monday the Report was read and passed, and additional points raised by Delegates were considered.

On the proposal of Col. C. H. Birdseye the following telegram was addressed to Prof. A. Penck at the University of California: "The Conference on the International Map of the World assembled at the Royal Geographical Society London sends greetings to you as the initiator of this international undertaking which is now making excellent progress."

A question was raised concerning the style of romanization employed in the spelling of Japanese names, full particulars of which are given elsewhere in this *Journal*, and the following resolution was passed:

> The Conference on the International Map of the World, assembled at the Royal Geographical Society, London, suggests to Professor Naomasa Yamasaki, Delegate of the Japanese Government, that his Government should be approached with the request that one official form of romanization of Japanese place-names may be adopted.

The question as to what constituted a genuine sheet of the International Map was again brought forward, and it was decided that in future only sheets conforming rigidly to the conventions should bear the title of the International Map. The Central Bureau intends to issue with the Annual Report two or more index diagrams, one of which would indicate only those sheets that strictly followed the conventions; other sheets, though in many respects closely resembling the International Map, would appear on another index diagram. In cases of two interested countries producing separate versions of the same sheet, it was decided that the work of co-ordination should be in the hands of the Central Bureau, which would draw the attention of the two countries to the desirability of the sheet being undertaken by one or the other or, in the event of both wishing to produce it, of the work being coordinated.

This concluded the labours of the Commission. When the Report was read at Cambridge the thanks of the International Geographical Congress were given especially to the Secretary of the Central Bureau, Major D. A. Hutchison.

J. H. R.

SCIENTIFIC EXPLORATION IN SVALBARD

WE are informed by the newly constituted authority that the Norwegian Government has sent to Foreign Powers the following memorandum relating to the Organization of Survey and Scientific Exploration in Svalbard (Spitsbergen):

The Norwegian Government has established a central institution under the Ministry of Trade for the exploration of Svalbard and polar regions. This institution, the name of which is *Norges Svalbard- og Ishavs-undersøkelser* (Norwegian Scientific Exploration of Svalbard and Polar Regions), 34 Bygdø allé, Oslo, embraces, *inter alia*, all official survey and geological work, and other natural, historical, and geophysical exploration in Svalbard; also the survey of adjacent waters. This does not, however, include meteorological observations, which remain under the Meteorological Institute in Oslo, or special fisheries research, which is attached to the Fisheries Board at Bergen.

In order to achieve the best possible results in the scientific exploration of Svalbard it is essential that all expeditions intending to carry on such work in those islands give notification thereof to the Norwegian Ministry of Foreign Affairs, and, in addition, send in particulars respecting the expedition to *Norges Svalbard- og Ishavs-undersøkelser*. These particulars should comprise a statement of plans: the scientific work to be undertaken; the territory to be covered; equipment, vessel, provisions, and personnel. *The Norges Svalbard- og Ishavs-undersøkelser* will then consider such plans. It will ascertain whether the work contemplated has already been wholly or partly done, and whether there should chance to be other expeditions already operating in the same tracts or contemplating doing so. This institution will, on request, supply information about literature and maps bearing upon the work contemplated, about scientific material in course of preparation, and the making of maps that may be of value to the expedition; it can also give practical hints relating to natural conditions and equipment. In addition, this institution will be able to give advice as to the particular Norwegian port at which the expedition should call for equipment-control (see below), and furnish any other information required about sailings to Svalbard and of the possibility of procuring housing accommodation for the members of the expedition at the settlements in the islands. It is also the duty of the *Norges Svalbard- og Ishavs-undersøkelser* to give expeditions the necessary information relating to such Norwegian laws and regulations, *e.g.* close time provisions, as expeditions may be brought into contact with.

The services thus rendered other expeditions by this institution are to be entirely free of charge, providing expeditions do not require reports of a nature involving a considerable amount of work or extra outlay. If, however, the institution is to fill its position efficiently as an inquiry office for Svalbard, the expeditions, for their part, must immediately on their return home submit a preliminary report on the work done and the results achieved. Further, they must send in two copies of all papers, books, and maps that may be published as a result of their work.

With a view to getting out of the state of chaos that has prevailed so long in regard to geographical names in Svalbard, the Norwegian Government has initiated a comprehensive plan for the final determination of names for each locality. This work will be completed in about a year's time. To avoid further confusion in this direction each expedition desiring to give new geographical names must submit its proposals to the *Norges Svalbard- og Ishavs-undersøkelser;* foreign expeditions must send their proposals through the Norwegian Ministry of Foreign Affairs. This institution will consider such proposals and submit a

recommendation. The final decision lies with the competent Norwegian authority.

Further, attention is called to the fact that by Act of August 6, 1915 (see also Orders in Council of Dec. 15, 1917, Sept. 3, 1920, and Jan. 17, 1928), the equipment and provisioning of Norwegian expeditions to Arctic regions is subject to official control. This Act primarily concerns hunting expeditions, but applies also to expeditions fitted out at Norwegian ports for purposes other than hunting, when they state, or there is cause to believe, that they intend to spend part or the whole of the winter in those regions. It moreover embraces expeditions made under such conditions as may necessitate wintering, even though this may not be intended. Then again, the provisions of this Act are applicable to foreign expeditions engaging as members Norwegian subjects in Norwegian ports, when it is stated, or there is cause to believe, that such expeditions have the intention of wintering or are proceeding to such tracts or such conditions as may necessitate wintering.

Expeditions must be notified to the *Politimester* (Superintendent of Police) at the port where they are fitted out; but in respect of foreign expeditions such notification may be given through the *Norges Svalbard- og Ishavs-undersøkelser*, in which event the Norwegian port from which the expedition intends to sail must be stated. Control is exercised by a committee comprising a government ship surveyor and a second member with experience of wintering conditions in Arctic regions; the latter shall be nominated by the president of the court.

It has been found necessary to exercise such a control as this Act establishes, for it happens not infrequently that expeditions and persons proceeding to Svalbard are so poorly equipped that they get into difficulties. If such an expedition is in distress some of its members may reach one of the settlements where there is a telegraph office and report that the remaining members are in peril and require immediate help. Should some time elapse without any news coming in about an expedition, demands for a search will very soon be heard. In such instances the Norwegian Government has had to send out or cause to be sent out relief expeditions. Also out of consideration for the coal-mining companies in Svalbard, the control of touring, hunting, and scientific expeditions is a necessity. It has happened that expeditions have arrived at Svalbard so deficiently fitted out that they have become a burden on the nearest mining community from the very first moment, and it is not always an easy matter for these mining companies to afford adequate help. In the summer months it does not matter so much, but it is a far more serious problem for these companies when members of some expedition or other that is in a helpless plight suddenly put in an appearance in mid-winter and have to be furnished with shelter, food, and medical aid, in addition to which an attempt may have to be made to send relief to those in distress.

As already mentioned, meteorological work in Svalbard is in the charge of the Norwegian Meteorological Institute. The Norwegian Government has established two meteorological stations in Svalbard, one being at Tunheim on Bear Island and the other at Ankershamn, Green Harbour. The Norwegian Meteorological Institute will, on request, give scientific expeditions wishing to work in Svalbard all necessary information respecting climatic conditions and the meteorological work done there.

Further, it may be pointed out that the *Norges Svalbard- og Ishavs-undersøkelser* publishes *Skrifter om Svalbard og Ishavet*, giving an account of all scientific results published in Norway from those regions. Foreigners will also be given the opportunity of having their papers printed in this publication series, on condition that they defray the cost of printing.

COMPARATIVE METEOROLOGY—A REVIEW

MANUAL OF METEOROLOGY. Vol. II Comparative Meteorology. By Sir NAPIER SHAW, with the assistance of ELAINE AUSTIN, M.A. *Cambridge: University Press* 1928. 10×7 *inches;* xi+446 *pages.* 36*s*

COMPARATIVE Meteorology as treated in this volume bears very closely on geography both in content and method. Sir Napier Shaw defines the scope of the work in the opening words of his preface thus:

"From the study of Meteorology in History as set out in the introductory volume of this Manual the conclusion was arrived at that the primary need of the science was a sufficient knowledge of the facts about the atmosphere in its length and breadth and thickness to furnish a satisfactory representation of the general circulation and its changes. The present volume is intended to provide the reader with the means of making himself acquainted with the nature and extent of the material which is available for satisfying that need."

The data dealt with are prodigious in amount and the manner of handling them is suited to the earnest student of meteorology who is prepared to assimilate many new and far from self-explanatory terms of science. The book begins conveniently with twenty pages of definitions and explanations of technical terms, acquaintance with which is essential to a full understanding of the chapters which follow. Terminology does not, however, enter into the aspect of the work demanding special attention in this review, which is concerned with the geographical basis on which rests the meteorology of the atmosphere as a whole.

Geographers recognize four contour lines as of special significance in physical geography, that of the mean level of the lithosphere, far below the surface of the sea, that of 200 metres or 600 feet below sea-level forming the lower limit of the continental shelf, that of the actual coast-line, and that of 200 metres or 600 feet above sea-level which on any small-scale map corresponds almost exactly to the mean level of the surface of the terraqueous sphere. Sir Napier Shaw points out that the last-named contour line has also a special importance for meteorology, forming a sort of second coast-line so far as the greater movements of the atmosphere are concerned. Below 200 metres he says that the irregularities of the surface exercise little effect on such phenomena as the travel of cyclonic depressions. He might perhaps have noted that in the case of the orographic control of rainfall sharp variations of even 20 metres in height do in fact give rise to quite definite diversities in the normal distribution of annual rainfall in flat districts, though they are quite without influence on cyclonic or convectional rainfall.

A large part of the volume is occupied by monthly maps of normal distribution of the various meteorological elements, the maps being in pairs representing the northern and southern hemispheres respectively. The compilation of these maps from widely scattered sources must have entailed much exacting labour, and we fully share the author's regret that it was not possible to reproduce them on a larger scale. Ample as the breadth of the page may be for ordinary illustrations it only admits an equatorial circle 5 inches in diameter. This small scale and the different projection make it difficult to note the changes due to recent observations in all parts of the world, by comparing the new maps with those, for example, in the Meteorological Atlas compiled by Dr. A. Buchan for the *Challenger* Reports forty years ago.

The fact that they are reduced from maps published by many different authorities and now pieced together for the first time no doubt accounts for the variations of treatment shown in different regions. A surprising instance is that in the case of almost all the elements of climate the isopleths of Greenland are

shown in greater detail than those of India. Monthly isotherms and isobars for the interior of Greenland must of course be entirely hypothetical, and this must also be true for parts of Africa and South America. In such cases dotted lines might well have been used. No claim however is made that the maps, interesting as they are, are of more than diagrammatic value. Even so they are of great importance and some are the first of their kind to be attempted. Each series consists of a normal annual map and twelve normal monthly maps of the two hemispheres, and the elements dealt with are as follows: Mean air temperature at sea-level (pp. 58–83), normal distribution of cloud (pp. 146–171), normal distribution of rainfall (pp. 178–203), and mean atmospheric pressure (pp. 216–241). In addition to these complete sets there are maps of mean daily range of temperature for the year, mean temperature of the sea-surface for February, May, August and November (pp. 88–95), and of normal pressure at 4000 metres above sea-level for January and June, as well as of winds and ocean currents in less detail. The space below each map is utilized with great ingenuity to present a number of interesting diagrams and useful tables of numerical data. The information as to sources of the data which have been utilized supplies a valuable bibliography of climatological maps not to be found elsewhere, and the brief descriptions and more detailed theoretical discussions as to atmospheric circulation unite to show how vital geographical methods are in meteorological research. We refrain from entering here into the many aspects of the book which commend it to meteorologists. Like everything which comes from the author's pen it bears the impress of his own individuality and carries the authority of the leading meteorologist of the century.

Sir Napier Shaw seems to revel in the profusion of the data with which he plays like a miser plunging his hands into a pot of gold, showing us samples of the riches of which he promises a full account in the volumes that are still to come. No one can even turn over the pages casually without being struck with the immense knowledge of the author and the original and ingenious methods of elucidation which he employs.

The fullness and excellence of the index make reference easy.

HUGH ROBERT MILL.

WESSEX FROM THE AIR. By O. G. S. CRAWFORD, F.S.A., and ALEXANDER KEILLER, F.S.A., F.G.S. *Oxford: Clarendon Press (London : Humphrey Milford)* 1928. 12×9 *inches;* xii+264 *pages; plans and illustrations.* £2 10*s*

In 1924 Messrs. O. G. S. Crawford and Alexander Keiller took vertical photographs from the air of interesting prehistoric sites in Wessex, fifty of which are reproduced in this book. The use of the airplane in making preliminary surveys for archæological purposes, though quite recent, is already fully established, and results are quite remarkable not only in revealing, inside and around known earthworks, roads, banks, ditches, and other features the discovery of which on the ground would probably have entailed the digging of many hundreds of yards of trenches, but also in bringing to notice entirely new sites. It is hardly necessary to labour the point, but a telling example has just come within the reviewer's experience. The Trundle (Ring), an Early-Iron-Age earthwork on the top of the hill by Goodwood racecourse, is well known. It is probable that a careful examination of the interior on the ground would have revealed an inner fosse and bank, but it is certain that nothing but exhaustive and exhausting digging would have shown up, and then only piece-meal, the very peculiar spiral fosse outside this, with an odd loop outside the main vallum on the west. An air photograph demonstrated the existence of this and other features; and the excavator, using the air picture and a heavy rammer on the chalk ground to locate the hollow places filled with silt, has had comparatively little difficulty in getting on to the main lines of what are almost certainly Neolithic defences. England, which every year proves to be richer in Roman remains than was supposed, is far richer in prehistoric sites; and if, as seems probable, this new instrument of discovery is fully used, English archæologists will be busy for many decades to come in providing the raw materials for a vastly extended pre-history of this country, or at any rate of the open country, especially the chalk downs of the south-east.

This book is both a demonstration of the archæological uses of the airplane, and a perfectly comprehensible—though somewhat expensive—handbook to the field archæology of the Wessex country. Its contents are a history and bibliography of archæology from the air; a general account of the different kinds of earthworks illustrated—camps, villages, ancient fields, barrows, and other mounds; a list of new sites discovered but not photographed (pp. 1–32); and plates and descriptive text (pp. 33–256). Bathampton Down (p. 144, Pl. 23) may be taken as an example of the last section. Here the rectangular divisions made by banks have been taken for the remains of a town or for Roman camps; the walls of the British camp have been assumed to be a stretch of Wansdyke; and few have been critical enough to imagine that the various ancient remains are anything but contemporary. An air photograph, followed by laborious walking over the ground to check indications and to test the nature of curved and straight lines and sporadic mounds, provides a new starting-point and gives the following results. The fields, lynchets, and hollow ways, resembling those on Marlborough Downs and Park Brow in Sussex, were probably laid out in prehistoric times—how early it were difficult to say. Then the fosse of the camp was dug and the rampart thrown up round the hill-top, before the Roman conquest, the field boundaries being interrupted by the rampart. Once more the fields were cultivated in Roman times while the camp walls were allowed to decay. Finally, cultivation came to an end with the passing of Roman civilization and peace. Such is Mr. Crawford's reasonable reconstruction; and he suggests, as usual, helpful work for excavators, *e.g.* to cut a division or two to see what is

the nature of the lower courses of these dry stone walls, expose native British masonry—a *rara avis* in England—and reveal the footings, if they exist, of these walls under the rampart. Work for idle spades to do is suggested in plenty in pp. 25–31. A rather similar case of a British camp divided by cultivation banks is provided by Ogbury Camp, Wilts. We take at random plate XIX, Overton Down, near Marlborough, and note that an airplane photograph revealed for the first time quite a series of antiquities, including field divisions, the direction of the "lands"—Celtic or earlier—of ancient ploughing, lynchets negative and positive, mounds and Sarsen stones. Of course many of the points brought out by photographs are not explicable by mere conjecture, but wait for pick and spade to provide a final answer, such as Dr. R. C. C. Clay gives in the case of Wudu-Burh, on the south slope of Knighton Hill, Wilts. This "Camp of the Wood" was an Early-Iron-Age earthwork, subsequently used in British times as a cattle enclosure.

This is one of the most useful books on archæology of recent years—full of book learning, common sense, keen appreciation of field problems, and stimulating suggestion. S. E. W.

THE PLACE-NAMES OF THE NORTH RIDING OF YORKSHIRE. By A. H. SMITH. (English Place-Name Society, vol 5.) *Cambridge: University Press* 1928. 9×6 *inches;* xlvi+352 *pages; map* (*in pocket*). 20*s*

"The present volume," state the general editors," is the first in which the whole of the primary task of collection, identification, and interpretation has been undertaken by another scholar, working on the lines laid down for the Survey generally and under the general supervision of its Editors. . . . The volume as now published differs widely in detail, and at times in general ideas, from the manuscript submitted to them at various stages." Thanks to the industry and acumen of scholars, the fascinating romance of English place-names continues to unfold itself. The geographical area now covered includes Teesdale, Swaledale, and Wensleydale, the Whitby Moors, and the country round Scarborough. It is highly interesting to note how the distribution of types of place-names, especially when taken in conjunction with archæological results, may be made to furnish new historical facts by reasonably safe inferences. Thus this volume offers many interesting discoveries in regard to the relative parts played by Angles, Danes, and Norsemen in the settlement of this country, and in particular shows how strong was the Irish element among the Norse invaders. These pages break new ground, for, unlike the counties already treated, the North Riding belongs to the Northumbrian group, and in modern times to the Northern area; and with the aid of Prof. C. H. Cowling's 'The Dialect of Hackness' it has been possible to make an extensive and correct record of local pronunciations of North Riding names.

The term "riding" is Scandinavian, and shows that the division of Yorkshire into ridings is later than the Danish settlement of 876. Of the survival of a British population, as *e.g.* in Somerset, there is little place-name evidence, though it is not safe to infer that when British place-names were displaced the Celtic population did not persist, in subjection of course to Angle, Dane, or Norwegian. Twenty-six only are found; six possibly containing the OE. *Wealh*, a dozen river names, and eight place-names, of which only one—Catterick—is the name of a British settlement. The Briton seems to have survived in fertile districts like the Vale of York, not in isolated groups, nor occluded by natural obstacles; and the view that he lived side by side with the Angles is supported by the use of British personal names amongst the Angles, *e.g.* Caedmon, from British Catumannos. The rarity in turn of ancient Anglian names in this region

is explained by the thorough nature of the Scandinavian settlement: where Anglian names are most persistent is in the fertile valleys and along the central Roman road, called Leeming Lane and Watling Street in different sections.

The first recorded settlement of Scandinavians in England was effected in 876 when Healfdene and his Danish army "portioned out the land of the Northumbrians." Place-names, such as those in -thorp, -hulm, and -brink, show that the Danes settled only in the central and southern, *i.e.* the most fertile, parts of the Riding. They were followed early in the tenth century (probably before 915) by Norwegians from Ireland, who came mainly via Cumberland and the Pennines. The Irish Viking Ragnall mac Bicloch captured York, the county was divided into ridings (which were subdivided into Scandinavian wapentakes), and meeting-places for the Viking "things" were set up, as *e.g.* at Thingwall and Fingay Hill. Where Danes settled and where Norwegians, is in general clearly determined by place-names. The characteristic type of name ending in *-by*—150 of which are found in the North Riding, 100 of them having a personal name as first element—seems to indicate the earlier settlement of Danes. (The fusion of Angles and Scandinavians probably resulted in a temporary Anglo-Scandinavian dialect; and archæology bears out place-name evidence, for a cross at Skelton has an Anglo-Scandinavian inscription.) The Danes settled far more in the south than in the north, witness the *thorps* in Bulmer wapentake—Gunthorpe, Mowthorpe, Wiganthorpe, Coneysthorpe. Names and crosses with Irish influence in their ornament are good evidence for the Norwegian settlement of Ryedale, Whitby Strand, and of the Hang wapentake of Richmondshire.

The name York and the names of places within the city will be dealt with in the West Riding volume.

It will be noticed that the number of cases in which place-names are explained by the assumption of personal names not evidenced is fairly large. A certain number of fresh elements (apart from personal names), *i.e.* elements not dealt with in the introductory volume 'Chief Elements used in English Place-Names'—*e.g.* boga, laela, skor—are found in this volume, so that the earlier volume will certainly have to be revised at the end of the survey. A few sample explanations will show how easily popular adaptations of names run off the rails. Thus Howlgate is the road through the hollow, and Birdgate the road to the stronghold; Foulbridge is Fulk's bridge; Easingwold, the highland of Esa and his followers; Sinnington, the place on the river Seven; Hancow Ho (which looks Chinese) is Haneca's spur of land; Killing Nab Scar (which seems to imply bloodshed) is Killing's projecting rock; Strensall, Streon's nook of land; Flavith, ford by the flat meadow-land; Hinderskelfe (the old name for the Castle Howard township), Hildr's seat; Amotherby (pron. Amerby), Edmund's farm; Misperton, farm with the medlar tree; Brompton, enclosed land overgrown with gorse; Osgodby, Asgant's farm; Ruswarp, silt land overgrown with brushwood—these are a few specimens of less obvious connotations. S. E. W.

SOMERSET. By PHYLLIS WARD. (The Borzoi County Histories.) *London: Alfred A. Knopf* 1928. 8×5 *inches; 112 pages; sketch-maps and illustrations.* 3*s* 6*d*

The series of which this is one is designed to present the history of the counties on a chronological basis. What can be done in a hundred pages to sketch the physical and geological features of Somerset and to tell the story of the successive ages of its inhabitants from prehistoric times, through Roman, Saxon, and subsequent epochs to the Industrial Revolution, is adequately and simply done by the author. Photographic and line illustrations and sketch-maps of the county at different periods are helpful.

THE INVASION OF EUROPE BY THE BARBARIANS. By J. B. BURY. *London: Macmillan* 1928. 9×6 *inches;* xii+296 *pages.* 12*s* 6*d*

In these lectures the late Professor Bury traces very clearly the expansion of the Germanic tribes from their homes in South Scandinavia and Denmark across Europe. Their actual assaults upon the Roman Empire begin in the middle of the third century, and he follows their history down to the eighth century, when territorial law and administrative machinery in Italy have become Lombardic. He covers, that is, the period often called the "Fall of the Roman Empire;" but even in Western Europe he will not allow the justice of this phrase. It is an "unfortunate expression." The Roman Empire cannot be considered to have fallen when Germanic nations, settled within the frontiers, including the Italian, could be fitted, at least theoretically, into the old Imperial order; when the barbarian leaders continued to look to Constantinople for recognition. The demonstration in detail of this historical continuity is the theme of the work. Writing out of a profound knowledge, Prof. Bury is able to give an almost deceptive clarity to the confused and obscure events of this period. The reader with little specialized knowledge can follow the greater part with ease. He will find most profit in those passages wherein from time to time Prof. Bury pauses in his narrative to revalue the significance of a man or of an event, or to indicate the general principles at stake. He shows for example that though the population of the Empire before the main barbarian attack was roughly seventy millions, or about one-third of the present total, its rulers could scarcely put an army of 50,000 men in the field, and further that, contrary to the general impression, the barbarian armies generally met them on fairly equal terms.

In his opening chapters Prof. Bury glances in passing at the influence of geographical conditions upon early German history: while recognizing their importance he treats them briefly, practically summarizing them in the statement that "Central Europe consisted largely of dense forests and marshlands" with some districts freed from woods. The latter he calls steppes, and gives as examples the plain of the Upper Rhine and the eastern portion of the Harz region! He then contrasts the West Germans, hemmed back by the Rhine frontier, becoming agriculturalists and increasing in numbers, with the East Germans who remain pastoralists and nomads. The latter, though he does not mention it, had access to the real steppe lands of Eastern Europe. He then points out, first, that even on the Rhine it was the East Germans, *i.e.* the nomads, that broke through the Roman defences, and secondly that this was possible only because of the "turning movements" of other tribes in Rhætia and Northern Italy.

To trace the course of the Barbarian raids upon a physical map affords much interest. (Incidentally there are no maps in this volume.) The invaders in the west enter through the Main valley; the Burgundians turn up the Rhine valley, and eventually penetrate the "Burgundian Gate." The Vandal hordes strike through the Moselle valley to Trier and Rheims, turn northwards to the plains of Flanders and then cross the Seine and Loire on the way to Spain. These richer lands of Gaul were the core of the last Roman resistance under Syagrius, and later the basis of the first stable Frankish kingdom formed by the agricultural West Germans who followed in the rear of their nomadic brethren. The influence which the rich grain lands of North Africa exerted upon the policy of Roman and barbarian alike is also apparent. In attracting the Vandals so far afield it dispersed and so weakened their forces. The existence of Rome depended upon maintaining communications across the Mediterranean, as did the continuance of some smaller barbarian states. It is also worth noting that the author does not attribute even the inroads of the Huns, as is sometimes

done, to increasing aridity in Central Asia. Political revolutions, testified to by Chinese annalists, were sufficient in his eyes to account for them all.

These are but disjointed and brief considerations from a geographical standpoint of an important historical work, not the least absorbing feature of which is the author's critical handling of conflicting or biased evidence—a valuable lesson for all students. From 1902, the year of his appointment to the Regius Professorship of Modern History at Cambridge until his death in 1927, Prof. Bury gave this series of lectures annually, incorporating, as occasion demanded, the results of further research. The task of seeing them through the press in their final form has been adequately carried out by Prof. F. J. C. Hearnshaw.

G. R. C.

IL PIEMONTE NELL' ANTICHITA CLASSICA: SAGGIO DI COROGRAFIA STORICA. By DINO GRIBAUDI. *Torino: Silvestrelli & Capelletto* 1928. 10×6 *inches;* viii+316 *pages.* 35 *lire*

Signor Gribaudi's first motive in putting together this solid and valuable contribution to regional studies has been to emphasize from a geologist's and geographer's point of view the physical features of Piedmont as distinguished from those of the lower valley of the Po—the Lombard Plain; his next and chief object has been, by amassing quotations from classical writers, to lead his readers to appreciate to what extent these features were familiar to the Romans and have influenced the course of history.

Piedmont, S. Gribaudi points out, deserves its name. It is essentially a subalpine region, surrounded by the Alps and the hills of Monferrat. The Alps have here no lesser ranges like those that fringe them elsewhere; but the great glaciers that once upon a time flowed out of their valleys have pushed into the level country prodigious embankments, so that less than 20 per cent. of the surface of Piedmont can be counted as plain. The passes to which these valleys lead offered, south of Mont Blanc, a choice of relatively practicable routes for Gallic tribes or Roman armies. The Piedmontese Alps have in history served rather as a corridor than as a barrier. Piedmont has been throughout the centuries a place of passage, the western gate of Italy.

A most laborious piece of work has in this volume been thoroughly and successfully carried out. The author's quotations range over a wide area and in all cases he gives exact references to the original texts. Nor has S. Gribaudi limited his literary researches to classical writers. He has extended his task by consulting and frequently citing members of the crowd of modern commentators—Italian, Swiss, French, and German—who have contributed to the study of his subject. To works in English he refers more sparingly. We find references to Smith and Bunbury of the Classical Dictionaries and to a work by Coolidge. But other names, for example Long, Ball, Bullock-Hall, Spenser Wilkinson, and Freshfield, are absent. Yet he endorses emphatically the last-named author's claim for the Col de l'Argentière to be counted among the Great Passes. "This Col," he writes, "which leads from Cuneo to Barcellonette in the valley of the Ubayette, offers itself as without question the easiest and most direct of the passes by which from the Piedmontese plain it is possible to reach the Narbonensis." Further, he agrees with Mr. Freshfield in refusing to believe (p. 125) that the generations of Romans established at Susa can have been unaware of the existence of the Mont Cenis, a pass the military and commercial importance of which was thoroughly appreciated from the beginning of the Middle Ages.

Throughout our author's pages we find him taking into account both the geological features and the plastic details of the mountains. He devotes chapters to their forests, and the gold-mines which in the case of the Salassi influenced

history. He enters into details as to the limits of the Roman Provinces and the consequent situation of custom-houses. We note that he considers the Col d'Altare as the limit between the Alps and Apennines, and as a rule follows the decisions and nomenclature of the Italian Military Commission recently summarized in our pages (*G.J.*, vol 71, 37).

S. Gribaudi has failed to avoid the inevitable reference to the "Pass of Hannibal." He is content however to accept the view of De Sanctis, a recent historian, in favour of the Mont Genèvre. This is one of the more reasonable guesses, and we will not reopen the controversy further than by pointing out that there is one crucial point the partisans of the Mont Genèvre have not yet met. If Hannibal crossed the Genèvre what pass did Pompey cross? One must be found for him. He wrote himself to the Senate that as a short cut to Spain his route was preferable to Hannibal's. Varro also asserts it was different from Hannibal's, while Polybius says that Hannibal crossed the Taurine Pass. The riddle still calls for solution. What was the southern limit of the Taurini? But enough of Hannibal!

We might find other details to argue over: but S. Gribaudi's volume may be welcomed as a substantial contribution to Alpine and historical literature. Its pages give proof not only of unlimited zeal and perseverance in scholarly research but also of geographic imagination. He succeeds both in enabling his readers to appreciate the natural features of Piedmont and in helping them to see their scenery from the classical point of view. Roman writers—Livy and Virgil—if they were repelled by the "Horrors" of the High Alps, show that they were not blind either to the charms of the sunny spaces of the Italian valleys, their fertile fields and forests, or to the beauty of the great subalpine lakes, Larius and Benacus.

ANNUAL REPORT ON THE MINERAL RESOURCES OF THE U.S.S.R. during the Fiscal Year 1925–26. *St. Petersburg: Published by the Geological Committee* 1927. 10×7 *inches;* 804 *pages*

The Editors explain that this volume, which is presumably to be issued annually, is published in order to render public as quickly as possible the results of the work of the staff of the Geological Committee carried out during the summer field season, and to review the progress of the Russian mining industry. Apart from the Editorial and the General Summary of seven pages in English, practically the whole work is in Russian. The statistical tables in each section are, however, given in both Russian and English. Those showing world production and world trade in various minerals are not important to non-Russians since the figures are more readily available from other sources. To one who does not read Russian the usefulness of the volume is thus restricted to the tables giving the production, and export or import of the principal mineral commodities in the U.S.S.R. The figures are given, in general, for the years 1922–23 to 1925–26, in some cases with 1913 for comparison. Nineteen minerals show an increased production over 1913 compared with twenty showing a decrease, but the latter number seems to include all the important ones—iron ores, gold, copper, lead, zinc, silver, mercury, oil, coal, and salt. L. D. S.

ARMENIA AND THE NEAR EAST. By FRIDTJOF NANSEN. *London: George Allen & Unwin Ltd.* 1928. 9×5 *inches;* 324 *pages; illustrations and map.* 15*s*

Of this book of 324 pages, roughly one-third is devoted to Constantinople, Tiflis and Georgia and the journey thither in 1925, though it might be imagined that it refers to a more recent period. This portion of the book cannot be regarded as a contribution to the world's knowledge and was perhaps scarcely worth translating into English from Norwegian, in which tongue the book first

appeared. The author does not seem to have had recourse to original authorities, nor to recognized experts on Georgia such as Sir O. Wardrop, Mr. J. F. Baddeley or Mr. W. E. D. Allen, and what he writes both as regards past events and "present" (1925) tendencies in Constantinople and Georgia must be accepted with reserve.

One-third of the book is devoted to a historical summary of Armenian history from the Stone Age to 1924. This portion, too, is compiled from existing books and contains little or no new material.

The origin of Dr. Nansen's visit to Armenia was a scheme submitted to the Council of the League of Nations for transferring 50,000 refugees to the so-called Sardarabad desert, in the Soviet Republic of Armenia, which was to be irrigated and cultivated at a cost of one million pounds sterling, to be raised by the League. The scheme seems to have been favoured in principle by the League's officials, but M. Tchitcherin made it clear from the first that Dr. Nansen and his colleagues could not visit Armenia as representatives of the League of Nations, which is not recognized by the U.S.S.R. To this condition Dr. Nansen agreed, and proceeded, the upshot of his investigations being in due course reported to the League of Nations and published by that body.

Chapters v to x inclusive deal, in somewhat rambling fashion, with this scheme, information regarding which is more easily obtainable from the report of the League above cited. No attempt is made by Dr. Nansen to marshal the arguments for and against the scheme: he contents himself with saying (p. 7) that "if these proposals can be carried out, I am convinced that they will be the beginning of a new era of development in Armenia, and will do a great deal to make the future happier for its gifted people and its numerous refugees." This is very likely true, but it scarcely disposes of the broad questions of principle, policy and finance involved.

Some thirty pages in all are devoted directly to a description of the scheme, to examine which Dr. Nansen went to Armenia: this portion of the book is of much interest and some value, but nowhere is there any attempt critically to examine the question, nor to answer the objections raised by experienced men whose desire to help the cause of Armenia was unquestioned and whose record of unselfish work in this cause should have ensured them a respectful hearing.

Dr. Nansen has some hard things to say regarding the attitude towards Armenia of the Allied and Associated Powers, and his views are the more weighty because he expresses them temperately and with conviction, but as to the merits of the scheme which he sponsored, perhaps too precipitately, and which he went to examine, he is less convincing. That it has not borne fruit may well be due less to the failings of the League of Nations or the indifference of the U.S.A. than to the fact that the scheme itself was not well thought out or financially sound, and in consequence failed to survive criticism at the hands of experts.

The book would have been better for a bibliography: the works quoted in footnotes by no means constitute an adequate list of authorities, and it suffers from the absence of an index. A. T. W.

THE WILDERNESS OF SINAI: a record of Two Years' Recent Exploration. By H. J. L. BEADNELL. *London: Edward Arnold & Co.* 1927. 9×6 *inches;* xvi+180 *pages; maps and illustrations.* 10s 6d

This description of Central Sinai is the best that has appeared of the interesting tract of country lying between the Gulf of Suez and the Gulf of Aqaba. By his training as a geologist and his long acquaintance with the desert region of North-East Africa the author is exceptionally well fitted to interpret the complicated

geography of this mountain area; more than this, he is an enthusiastic lover of desert scenery and the vicissitudes of desert travel which he describes most attractively. The visit to Sinai was made in connection with a detailed examination of the peninsula by the Geological Survey of Egypt. The northern and the southern parts had been surveyed previously, so in 1921 Mr. Beadnell confined his attention to the central portion.

In addition to a very interesting account of the geological structure and characteristics, the general characters of the various parts are attractively described and their relation to the geology is clearly explained. Keenly interested in sport as well as in geology, the author records many incidents which occurred in his journeyings from place to place or on the traverses across country in connection with his work. Though no ibex fell to his gun during this expedition, he writes with enthusiasm of the excitement and the difficulties of stalking them with the aid of his Arab hunter.

Not the least difficult and certainly the most wearisome feature of such an expedition is the question of transport, and the author's account of organizing his camel transport, of dealing with the nomad Arabs who were his camelmen, messengers, hunters, etc., gives an excellent idea of the patience and tact which a successful expedition demands. Travelling alone but for his Arab personnel, it was no mean achievement to carry out the mapping of the district and to make an exhaustive geological examination of it while organizing at the same time the necessary transport. The account of it all makes a book full of attraction for any traveller, especially those who know the desert regions, and at the same time gives an accurate account of the geographical and geological characters of a region of very exceptional interest. H. G. L.

POPULAR HANDBOOK OF INDIAN BIRDS. By HUGH WHISTLER, F.L.S., F.Z.S. *London: Gurney & Jackson* 1928. 9×6 *inches;* xxiv+438 *pages; illustrated with* 17 *full-page plates* (81 *figures*) *of which* 4 *are coloured, and* 85 *figures in the text, from drawings by H. Grönvold.* 15*s*

This book fills a distinct want. Many an Englishman arriving in India is immediately attracted by its bird-life. He is not an ornithologist, just a lover of Nature who wants to know the birds he sees. How can he get the required information? He may consult the volumes of the 'Fauna of India' or he may have recourse to a few sketchy books. The Fauna volumes will certainly frighten him. Their vastness of material and technical descriptions will probably terminate his ornithological inquiries. The sketchy books will have the same result through failing to tell him what he wishes to find out. In India there is nothing to help the beginner like the popular bird-books that we have in England. And many an ornithologist must have failed to develop through the lack of a suitable handbook to guide him in a difficult maze.

Mr. Whistler's book comes into the breach. Here we have something for the lover of birds, a book that will give him accurate information, not too popular, not too scientific, yet clear, precise, easily found out, and sufficient to enable him, both by description and illustration, to identify the birds he is likely to see. Two hundred and fifty species are dealt with. There is a description of each, a statement of how to identify it in the field, an account of its distribution, and, what we think of special importance, a full and excellent summary of its habits. Moreover there are 166 illustrations, a help of the greatest value at the early stages of ornithological inquiry.

Both as a systematic and field naturalist Mr. Whistler stands in the first rank. His intimacy with the birds of India is unrivalled, and his name is sufficient to ensure the accuracy of this large assemblage of ornithological facts.

R. W. G. H.

THE GEOLOGY OF MALAYAN ORE-DEPOSITS. By J. B. SCRIVENOR. *London: Macmillan* 1928. 9×6 *inches;* xvi+216 *pages;* 48 *figures,* 3 *folding plates.* 16*s*

Tin mining and rubber planting may be described as the mainstays of the present prosperity of Malaya, and no one is better qualified than Mr. Scrivenor to give an account of the mining activities of the peninsula. He has been officially engaged in the study of Malayan geology for a quarter of a century, his earlier reports dating from 1904. The author explains in the preface that he has selected for description only certain examples from the mineral deposits which he regards as important as types, or as having individual peculiarities. Nevertheless the detailed descriptions occupy the bulk of the volume. One cannot help regretting that the author has interpreted his subject in a very narrow sense, and whilst an important contribution to mining geology, the book does little to advance our knowledge of the general geology of Malaya. The chapter giving a "general geological sketch and distribution of the ore-deposits" occupies precisely four pages of text—an inadequate foundation for the details which follow in the succeeding 200 pages. Not unnaturally, one turns to the present volume for an authoritative statement on the vexed question of the age of the granites of South-Eastern Asia—such a fundamental problem in the geology of the whole continent—with which the great tin deposits are associated. One only learns, however, that "evidence in Borneo indicates that it [*i.e.* the granite] is younger than the Cenomanian" (pp. 1–2), or that the granites "were intruded between Rhætic and Cenomanian times" (p. 3)—statements which are mutually contradictory. Nor does the author help to solve the problem of the geology of the Kinta valley, being content to accept Dr. Rastall's conclusions as a working hypothesis, though he does not agree with Dr. Rastall regarding the age of the Batu Gajah boulder clays—merely stating that "evidence I have collected points to their being older" than the granite (p. 50). One must protest, too, that "it is difficult perhaps for any one unacquainted with Malaya to realize how granite can flow" conveys an entirely wrong meaning. L. D. S.

MY TWO AFRICAN JOURNEYS. By FRANK GRAY. *London: Methuen & Co.* 1928. 9×6 *inches;* xiv+272 *pages; sketch-maps and illustrations.* 15*s*

In 1925 Mr. Gray set out on a seven months' tour of West Africa. His interests being chiefly commercial, he spent most of his time as the guest of traders and miners. Herein lies the chief value of his book, for his point of view differs from that of the average tourist, whose time is usually spent in Government circles.

In Nigeria, the Gold Coast, and Sierra Leone he followed well-beaten tracks, and consequently has little new to tell of these dependencies. But he was keenly interested in all he saw, and the account of his journey makes agreeable reading. He wisely seized the opportunity of visiting the neighbouring French territories of Dahomey and Togoland, as well as Liberia. His pictures of life in these less-known regions are well drawn and full of interest. He found much to praise in French methods, and he writes enthusiastically of the French senior officials, but is not so kindly disposed towards the junior ranks. His opinion that conscription is popular with the natives of French West Africa is markedly at variance with the experience of other travellers. In Liberia Mr. Gray saw much to amuse and interest him. His description of the unhappy conditions he found there is true enough, and the strictures he passes on certain missionary enterprises may come as a timely warning to those who are undiscriminating in their charity.

Mr. Gray's second journey was the result of a sporting offer he made to British motor-car manufacturers "to buy any two cars, test them by a journey across Africa without any advance dumps or special arrangements, on the understand-

ing that, if the cars succeeded by reaching Khartoum, the cost of the cars was to be refunded to me." The challenge was accepted by one firm, and in due course Mr. Gray and a companion set out from Lagos for the Red Sea. How this enterprising journey was successfully accomplished is well told in the concluding part of the volume.

It is regrettable that the two maps omit several important places which the author visited. On p. 107 the reader is referred to a map in the Appendix showing details of railways, but there is no such map nor has the book an appendix.

E. W. B.

TIMBUCTOO. By LELAND HALL. *New York: Harper & Bros., Ltd.* 1927. 9×6 *inches;* xvi+278 *pages; illustrations.* 15*s net*

Mr. Leland Hall, who is an American, boasts that he read nothing about Timbuktu before going there. "So I arrived," he writes, "without knowledge of it, without prejudice, with no preconceived ideas of it whatsoever." We can well believe it. That this is not the way to travel is abundantly proved by this unsatisfactory book. Its nearly 300 pages give no information and but poor entertainment. It is principally devoted to the antics and chatter of the author's servants, who, with their predatory friends, took full advantage of his strangely unconventional attitude towards natives.

E. W. B.

A GAME RANGER ON SAFARI. By A. BLANEY PERCIVAL. Edited by E. D. CUMING. *London: Nisbet & Co. Ltd.* 1928. 9×6 *inches;* xiv+305 *pages; illustrations and map.* 15*s*

This is not a book of sporting experiences, but a record of personal observations on the larger animals of Kenya Colony. It is essentially a nature study. The author begins with an interesting account of what a safari is actually like. He tells of the porters, their loads, their marches, their rations; of travel through various types of country; of the many difficulties encountered on a journey; of the picketing, the watering, the cooking, the doctoring, and other multifarious duties of camp.

Then we come to the natural history. The habits of a great many animals are dealt with. Antelopes, of course, receive the most attention; but chimpanzees, monkeys, gazelles, jackals, crocodiles, snakes, and many others are discussed in varying degrees of detail. The author has had a vast experience. He gives an account on first-hand authority of such points as the places these animals frequent, their feeding habits, their traits of character, their migrations, their enemies, their likes and dislikes, their peculiar methods of attack and defence. We were specially interested in the author's story of the terrible effects of drought and disease, also in his picture of the army of destroyers that pursue a wounded animal to its doom. The book thus consists of a crowd of facts, valuable, because secured by the most difficult of methods, long and careful observation in the field.

R. W. G. H.

VOM URWALD ZUR WÜSTE: NATUR- UND LEBENSBILDER AUS WESTAFRIKA. By LEO WAIBEL. 2nd edit. *Breslau: Ferdinand Hirt* 1928. 8×5 *inches;* 206 *pages; illustrations and a map. M.*6

The author recounts his experiences of Tropical Africa gained during 1911–1912 when he visited the Cameroons under the auspices of the Deutschen Kolonialgesellschaft, and later when from 1914 he remained in South-West Africa for five and a half years.

Four main types of country are described: the Forest, Savannah, Steppe and Desert; and two chapters are devoted to animal-life of the Forest and of the Steppe. Before concluding with his chapter on the Desert he devotes three chapters to special aspects of South-West Africa. These he terms "Farmer-

leben," the general conditions of farm-life in the country; "Auf Pad," which is a story of the great treks and a discussion on past and present means of communication; "Orlog," an account of the Colonial and guerilla wars, with the difficulties under which they were conducted.

The descriptions of the four main types of country are impressionist pen-pictures and convey a vivid idea of the vegetation characterizing each, which has been appreciated by a keen and receptive mind. The story differs from that usually provided by travellers in that it embodies the reflections of one who has dwelt amid the surroundings he describes and had time to observe the workings of Nature around him and inquire into the daily life and routine of the inhabitants. Whilst the author does not attempt to record any new scientific discoveries, his observations on the animal-life are full of interest, and he provides lists of the principal animals common to the chief types of country, with general descriptions of them and their habits.

His statement (p. 19) that the general absence of animals in the forest is due to the absence of grass and pasturage is perhaps a matter for consideration. He recognizes the influence of the tsetse fly (p. 63) only where forest and grassland adjoin. He remarks (p. 72) that "Pidgin-English" is the ordinary means of communication between white men and natives of the Cameroons: this may not perhaps be generally known.

The plates, which are well produced, show types of country, peoples, and animals, in explanation of the text. The plate facing p. 17 is an excellent illustration of the characteristic native village nestling under a forest-clad hill in the thick closed-forest country. The map of Africa is shaded to show the main types of vegetation occurring on the continent.

This interesting little book is worth reading by any one who contemplates visiting that part of Africa. T. F. C.

CHINSENGA HANDBOOK. A Manual of the Nsenga Language, spoken in the Protectorate of Northern Rhodesia. By A. SIDNEY B. RANGER. *London: The Sheldon Press* 1928. 8×5 *inches;* viii+338 *pages.* 10*s* 6*d*

Nsenga (Chinsenga) is a Bantu language spoken in the south-eastern corner of Northern Rhodesia by about 70,000 people. It has marked affinities with Bisa (Ŵiza) and Bemba (Ŵemba) on the one hand, and—*pace* Mr. Ranger—with Nyanja on the other. It possesses the usual eighteen noun-classes complete (even keeping the *lu* class distinct, which is almost lost in Nyanja), though the fact is somewhat disguised in this writer's arrangement. The account of the locative classes (on pp. 20, 21) is quite clear, but the author has been misled by his grammatical preconceptions into calling the prefix-pronouns "prepositions," which results, as on p. 132, in a curious inversion of relations. Meinhof, we may note, entirely denies the existence of prepositions in the Bantu languages, and, without going so far as this, we may point out that the more abstract parts of speech, as we understand them, are either wanting or can be seen in course of developing out of very concrete notions. Thus we find that "above" is "in the sky;" "below," "on the ground;" "in front," on the breast;" "behind," "on the back," etc.; and all that is needed to turn these adverbial expressions into "prepositions" is to add the particle equivalent to "of."

A careful study of this book would throw light on various obscure points in other languages; in particular, one might call attention to the remarks on the expression *ati* (pp. 213, 214), which exists as an isolated survival in Swahili and is clearly (though Mr. Ranger does not say so) the 3rd person singular of the verb *ti* (discussed on pp. 202–205). This verb is fully conjugated in Nsenga, as it is in Zulu and Nyanja, and is used very much as in the former.

Mr. Ranger's book is of interest from other points of view than the purely linguistic, as it contains, incidentally, some notes of undoubted value to the anthropologist: *e.g.* that on totem names (p. 119), the chapter on "Time and Weather," and the native tales in the Appendix. One of them, that of the Hare who stuck horns on his head with wax, appears to have a fairly wide circulation in Bantu Africa. A. W.

THE CLIMAX OF A WORLD QUEST: the story of Puget Sound, the Modern Mediterranean of the Pacific. By GEORGE F. COTTERILL. *Seattle: Olympic Publishing Co.* 1927. 9×6 *inches;* 228 *pages, and maps*

The first five chapters of this book give an account of the early history of the search for a north-west passage. By far the greater part of the book, the remaining twenty-nine chapters, consists, with few additions, of lengthy extracts from the journals of Captain George Vancouver's expedition made in the years 1791–1795. In the words of Mr. Cotterill, "Vancouver demonstrated that there was no north-west passage, but in dispelling that old illusion, he revealed the reality of an inland sea of the North Pacific." For this reason Mr. Cotterill calls his book 'The Climax of a World Quest.'

The author's description of Puget Sound as the modern Mediterranean of the Pacific is somewhat extravagant. Puget Sound cannot be compared with the Mediterranean of Europe in size, climate, or vegetation. The two maps in the book are inadequate, and they do not indicate the course of any explorer. This omission is all the more unfortunate because the author's identification of places named or visited by Vancouver is the most valuable part of the book. The extracts from Vancouver's journals should prove useful to those who have no access to the original volumes. E. W. G.

TO THE FOOT OF THE RAINBOW. By CLYDE KLUCKHOHN. *London: Eveleigh Nash & Grayson, Ltd.* 1928. 8×5 *inches;* 242 *pages;* 51 *illustrations.* 12*s* 6*d*

A volume of trivial incidents. The author relates details of a series of journeys to various parts of the country inhabited by Pueblo Indians, but has nothing new to say concerning regions that have, during the last decade, had their full share of attention. Navajo Indians were also visited, and a trip made to the fine natural "Rainbow Bridge" just across the Utah–Arizona boundary. Photographs taken in such picturesque country cannot fail to be of interest, although many of those shown are too personal to be informing; many of these illustrations, too, are poorly printed. There is no index.

HISTOIRE DE LA GUADELOUPE SOUS L'ANCIEN RÉGIME (1635–1789). By MAURICE SATINEAU. *Paris: Payot* 1928. 9×6 *inches;* 400 *pages; illustrations. Fr.*30

In this volume M. Satineau has not only broken almost entirely new ground, but in doing so has carried out a piece of thorough and accurate research. After a preliminary sketch of the discovery and settlement of Guadeloupe down to 1642, the author devotes himself exclusively to a study of the social and economic conditions in the island under the *Ancien Régime.* His analysis is based throughout on contemporary documents now lodged with the *Archives Nationales,* the great majority of which have not hitherto been utilized.

The reader who is acquainted with the history of the British West Indies will meet with many old friends among the economic problems here presented, and will gain a deeper insight by reason of this encounter in a different setting. M. Satineau traces the evolution of the mercantilist *pacte colonial* from Richelieu to Colbert, together with the fierce opposition which the system provoked

among the planters, and points out that it was Louis XVI who gave the system its *coup de grace* by his revolutionary edict of 1784. The introduction of sugar at the expense of cotton and indigo (as in the British islands) brought a great increase of wealth, but gradually drove out the small holder, who could not afford the necessary plant and labour. As a result of this and other factors, the negro slave replaced the white indentured servant. These economic developments, together with their social repercussions, are handled by the author with clarity and thoroughness.

In examining the commercial problem of Guadeloupe he shows how heavy was the handicap imposed upon the French colonial empire, despite the efforts of Colbert, by the fact that it never possessed an adequate merchant service of its own.

The final section of the book, which constitutes a detailed treatment of the moral and material condition of the negro slaves, makes painful reading, and reveals much the same degree of ill-treatment and ruthless suppression as obtained in the British islands. The last chapter on the economic and social consequences of slavery shows that in Guadeloupe, as elsewhere, the system not only degraded the community at the time, but left behind a poisoned atmosphere which has been responsible for the greatest problem of modern times—the colour problem.

M. Satineau's book is a storehouse of accurate and well-digested information, which has a high value for all students of colonial history, French or British.

V. T. H

LOS ABORIGENES DEL OCCIDENTE DE VENEZUELA. Por ALFREDO JAHN. *Caracas (Venezuela)* 1927. 9×6 *inches;* viii+416 *pages; illustrations, dialect table, and map*

Dr. Jahn has added an important volume to the scant material available for students of Venezuelan ethnography. The regions of the special investigations forming the basis of his book are situated, as the title indicates, in the western part of the Republic, and lie, for the most part, in the neighbourhood of the Cordillera spurs, and about the margins of Lake Maracaibo.

During 1910 to 1912 Dr. Jahn was engaged in investigations as head of a scientific mission confided to his care by the National Government of Venezuela; but as a sequel to this official work the author returned to the same regions in a series of expeditions from 1914 to 1917, and again in 1921 and 1922. In addition to ethnological work, the Andean system of Venezuela and its neighbourhood was mapped, and notes made upon the regional vegetation, climate, and geology; separate publications have already dealt, or will deal in the future, with these subjects, while the present book is the fruit of ethnographic studies. A careful account of the occupations, food, household and social customs, as well as the language, of certain of these aboriginal tribes is presented, the author dealing especially with the Motilones, Guajiros and Paraujanos of the State of Zulia, and with the Ayomanes, Gayones, and Timotes in the States of Lara, Trujillo, and Merida.

An English version of this useful record of little-known tribes would be no doubt appreciated; and should such work be undertaken it is to be hoped that an index, and a list of the copious but unnumbered illustrations, may be added.

L. E. E.

AERIAL PHOTOGRAPHY: A comprehensive survey of its practice and development. By CLARENCE WINCHESTER and F. L. WILLS, with a Foreword by Sir ALAN J. COBHAM, and Introductory Notes by Sir PETER CLUTTERBUCK and Sir FELIX J. C. POLE. *London: Chapman & Hall, Ltd.* 1928. 9×7 *inches;* xvi+236 *pages; illustrations.* 25*s net*

This book will serve very well to persuade corporations, railway companies, and factory owners that it will pay them to have their properties photographed from the air: the pictures make good publicity. It includes a great deal of miscellaneous information on photographic materials, lenses, and cameras, partly digested from makers' catalogues and text-books. Examples of imperfect digestion are easily found in the chapter on lenses, or in that on shutters. When we come to what should be the most interesting chapter on map-plotting, contouring, and rectifying, we find it composed of chunks taken mostly from German propagandist pamphlets. Thus the Integrator "produced by Karl Janzer (Stuttgart) is another example of German progress. . . . The many years of ceaseless experiment have resulted in the production of an instrument which is of extreme value to the aerial surveyor. . . . The apparatus is supported by strong underframe forces which bear all the mechanical gadgets of the instrument." In the INAG Double Projector "the scale is obtained by comparing the various distances. To find the bearings relative to the horizon is a purely physical problem. This depends upon the force of gravitation. The method adopted by the INAG is the determination of terrestrially measured differences in level. This determination of the horizontal levels represents the third stage. When the scale is known two differences in level will suffice. The plotting into a system of coordinates may now be effected in the customary manner." All this is illustrated by small photographs of the complicated mechanisms, but with no single figure to elucidate the geometry. And there is little indication that any of the machines are actually at work, no discussion of accuracy or rate of output, and no indication of their enormous cost. Part III, on Apparatus, is therefore most unsatisfactory. Part IV deals with the Application of Aerial Photography, and begins with general unconvincing statements like "By methods which are being improved by our scientists every day, it has become possible to contour economically from the air." The best chapter is that on Industrial and Municipal Application of Aerial Photography; but it is hard to believe that "the owner of a famous nursery at Amawalk-on-the-Hudson was able to secure in one photograph, a complete portrayal of all the species and foliage, actual number of the 350,000 trees, and their height. All the selling, practically, is now accomplished in the office hundreds of yards from the rolling acres across which the staff formerly trudged many weary miles daily." One would expect the purchasers to return like the villagers in O. Henry's story to "begin a conversation not unconnected with fruit trees."

It is a pity that an expensive and well-produced book should have so little real value. But that is inevitable if authors accept and set down all they are told by propagandists. A. R. H.

CLAVIJO. EMBASSY TO TAMERLANE, 1403–1406. Translated from the Spanish by GUY LE STRANGE, with an Introduction. (The Broadway Travellers, edited by Sir E. DENISON ROSS and EILEEN POWER.) *London: Routledge* 1928. 9×6 *inches;* xvi+376 *pages; maps and plans.* 15*s*

Clavijo's 'Embassy to Tamerlane' was edited by Sir Clements Markham for the Hakluyt Society in 1859. In view of the marked advance in our knowledge of Persia and Central Asia during the last seventy years, a new edition was long overdue, and no editor could have carried out the task better than Guy Le Strange, whose 'Lands of the Eastern Caliphate' is a mine of wealth on this part of Asia.

Timur, to give him his correct name, became the leading figure on the world's stage by his defeat of Sultan Bayazid at Angora in 1402. This astounding victory over the Turks saved Constantinople, which had seemed doomed to fall almost immediately, for fifty-one years. It also opened up intercourse between Timur and Europe, much as the earlier victories of Chingiz and his successors rather more than a century previously had opened the way for Marco Polo.

Henry III. of Castile, son-in-law of "time-honor'd Lancaster" and uncle of Henry the Navigator, was ahead of his generation. Realizing the importance of being in touch with events in Asia, he had despatched two envoys to Timur at Angora, who were well received by the Conqueror. After his victory he despatched an envoy to Castile with gifts of jewels and fair women, his representative being escorted to Spain by the Castilians.

Incidentally it is of special interest to note that Timur also wrote a letter to Henry IV. of England, offering his subjects free commercial intercourse. This letter and the reply, in which Timur was congratulated on his great victory, were conveyed by John Greenlaw, an English friar resident at Tabriz, who is also known as Archbishop John.

The visit of Timur's envoy, who no doubt conveyed an invitation, led to the despatch of Clavijo on a return embassy. Starting in 1403, the knight travelled by sea to Gaeta, Rhodes, and Constantinople, where he wrote an important account of the buildings and relics of the capital. Read in the light of the doom that was to fall on the city and its seven churches, his description possesses a pathetic interest.

Upon resuming their journey, the Castilians were wrecked a few leagues east of Constantinople and, after saving their lives and effects, wisely decided to await the spring before again tempting the uncertain Black Sea. To this delay we owe the long journey to Samarqand, as Tamerlane spent the winter in the Qarabagh plains.

The Ambassador finally reached Trebizond, where the land journey commenced, with his party and property intact. At that time the city was ruled by emperors of a Greek dynasty that had little power outside the limits of Trebizond, and paid tribute both to Timur and to the Turks. Clavijo arranged for transport and camp equipment, and started off for Erzinjan at the end of April 1404. He not only described the route, but gave interesting details about the various peoples, while his references to political questions are most illuminating.

Passing through Erzerum he reached Khoy, where he joined an ambassador sent to Timur by the Sultan of Egypt. Among the gifts of the Egyptian Sultan were a "jornufa," or giraffe, which naturally excited the keenest interest of the Spaniard, who described it most carefully. Tabriz impressed him deeply. Its "200,000 householders within the city limits," its immense concourse of traders and the business they transacted, were naturally a subject of marvel to a traveller coming from poverty-stricken Europe. Indeed, until Portugal opened the sea-route to India, the Moslem powers controlled the trade in spices and drained the wealth of the Christians.

The summer had now set in, and the travellers suffered alike from the heat and the long stages. At Jajarm, which is locally held to mean a Hot Place, one of the Spaniards nearly died from the heat, while the next stage to Isfarayin was a terribly long one. Le Strange mentions that this place has disappeared from the map. Actually the reviewer discovered its ruins in the middle of a blank on the map and quoted 'The Lands of the Eastern Caliphate' in proof of its former importance.*

Nishapur and the turquoise mines are next mentioned, and upon continuing

*"A Sixth Journey in Persia," *G.J.*, February 1911.

the journey Okhakhan is given as a stage. This may, in the reviewer's opinion, be identified with Pawajan, the ruins of which he noted a few miles to the west of Sharifabad. Meshed, or "the Place of Martyrdom," is famous as the burial-place of the Imam Riza, and Clavijo writes, "they brought us in to visit this sanctuary and the tomb." To-day no Christian is permitted to enter the sacred precincts. The ambassadors nearly died of thirst in the desert situated between the Hari Rud and the Murghab. They then crossed the Oxus, and, passing through the celebrated Iron Gates, finally reached Samarqand.

Tamerlane, whose prestige was enhanced by the appearance of ambassadors from distant Spain, received the knight with much kindness. He was invited to a series of banquets and gives a vivid account of Timur, his splendid court, the blue and gold tiles, his "paradises," and his stern justice. The Conqueror was very old, and instructed the ambassador "to stand close up to him that he might the better see us . . ., indeed, he was so infirm and old that his eyelids were falling over his eyes." There is an interesting, if disparaging, mention by Sharaf-u-Din, the historian of Timur's reign, of the ambassador which runs: "even the smallest of fish have their place in the sea."

An illness of Timur hastened the departure of the knight, who, after many adventures, finally reached Seville safely. To the staunch Clavijo we owe our deep thanks for the valuable and charming account he wrote of his journey to Golden Samarqand, while the "Broadway Travellers" may be congratulated on a notable addition to their series. P. M. S.

THE EVOLUTION AND CLASSIFICATION OF SOILS. By the late Dr. E. RAMANN; translated by C. L. WHITTLES. *Cambridge: Heffer* 1928. 9×5 *inches;* xii+128 *pages; illustrations.* 7*s* 6*d*

The study of the soil as a science separate from either geology or agricultural chemistry is one which has only recently gained ground in Britain. The soil is regarded as an independent body, determined by climate, vegetation, the parent rock, general geographical position, and living organisms. The author of this book devotes the first three chapters to a consideration of these points and emphasizes the importance of climate in determining soil. He defines soil "The uppermost weathered layers of the solid crust of the earth;" and proceeds to discuss weathering agents, especially water, in both their chemical and mechanical aspects. Most of the book is devoted to classification of soils, which is done clearly and well, in spite of the present state of uncertainty on many points. The author does not hesitate to point out problems that still await solution, such as, for instance, how it is that, with quite different climates, some soils in Eastern and Western Europe are surprisingly alike (p. 66). He first divides soils between Arid and Humid Zones; and then deals in detail with climatic soil zones, and especially with those of the Cool Temperate Zone.

It would be difficult to find a better introduction to the study of soil science than this little book. The translation has been well done. (Two misprints need correction: Hartz should be Harz, p. 67; and Hildersheim should be Hildesheim, p. 95.) There is an index to authors, a subject index, and a list of notes and references. Although in the Translator's Note (dated February 1928) one reads that a few additional notes and references have been made since the German edition, it is rather surprising to find no reference to works later than 1924; and in particular no reference to the recent work of the International Society of Soil Science (especially the publication of the General Map of the Soils of Europe, 1927); to the Series of Pedological Investigations published by the Academy of Sciences of the U.S.S.R. at Petrograd, 1927; to the publication of the American Geographical Society, 'Vegetation and Soils of Africa' by Marbut and Shantz.

Soil cartography is ignored, although reference might have been made to the Soil-Region Map of Hungary compiled by P. Treitz, published by the Royal Hungarian Geological Society in 1927; and the soil map of Russia-in-Europe by L. I. Prasolov, 1927. Finally, a reference should be made to Dr. Ogg's article on Soil Classification and Soil-Surveys in the *Scottish Geographical Magazine*, 15 July 1927.

Although the references are not quite up to date, one can certainly recommend this book to students of soil science, who will find therein many stimulating suggestions. A. B.

BIOLOGICAL CHEMISTRY AND PHYSICS OF SEA WATER. By H. W. Harvey. *Cambridge: University Press* 1928. 9×5 *inches;* x+194 *pages, and diagrams.* 10*s* 6*d*

The rapid advances in oceanography during the last ten or twelve years called for a book on this subject since researches in several countries have gone far ahead of available text-books. The descriptive stages of oceanography are far from completed, but meanwhile research into the physical characters of sea-water are throwing light on the conditions of life in the sea. Mr. Harvey has done a real service in compiling this book, and so bringing to notice recent advances in the subject which were published originally in many scattered sources in several languages. The area considered is limited to the North Atlantic and adjoining seas, but many of the facts in the book have a wider application. The subject-matter is divided under the headings of chemistry, movements, temperature, colour and illumination, and factors controlling density. Liberal bibliographical references are given for every section. The various problems are not treated in great detail. In places a longer discussion would not be amiss, for some of the pages are little more than summaries of recent work. Biologists will find most use for the book, but geographers should find it of interest as amplifying more general works on oceanography. It forms one of the volumes of the Cambridge Comparative Physiology series. R.N.R.B.

CRISTOFORO COLOMBO. By Roberto Almagià. 2a edizione. (Profili, N. 46.) *Rome: A. F. Formiggini.* 7×4 *inches;* 80 *pages, and a portrait*

This pleasantly written sketch, by the Professor of Geography at the University of Rome, is based throughout upon a full knowledge of the results of the most recent research. Within the limits at his disposal, it was clearly impossible for the author to enter into a detailed discussion of the more controversial aspects of his subject, and he makes no attempt to throw any new light upon those aspects. He was obliged to content himself with making his choice between conflicting views, and he has preferred those of Cesare de Lollis to those of Henry Vignaud.

Signor Almagià has succeeded in compressing into a small space a surprisingly large amount of information, without wearying the reader with a mere catalogue of facts, and without giving his narrative the appearance of being hurried. He may fairly be congratulated on having achieved his purpose of supplying the general Italian public with an adequate account of the life of Columbus as a navigator and explorer. The volume is a welcome addition to the excellent series of "Profili" in which it is included. C. J.

THE VOIAGE AND TRAVAYLE OF SYR JOHN MAUNDEVILLE, Knight, with the Journal of Frier Odoricus. With an introduction by Jules Bramont. Everyman's Library. *London: J. M. Dent & Son Ltd.* 1928. 7×4 *inches;* xviii+278 *pages.* 2*s*

This is a most useful reprint excellently introduced by Mr. Jules Bramont, who

sums up very neatly the attitude of modern scholars to Sir John Mandeville or Jean de Bourgogne, upon whom his friend and gossip Jean d'Outremeuse fathered one of the most remarkable travel books ever written. Thanks to the labours of Paul Hamelius, Sir George Warner, Dr. Vogels, and Cordier, we know far more about the work than did Ashton when he issued his reprint in 1887. We can trace d'Outremeuse's sources and see to some extent just how he did his work. And what a book it is! Here the reader can discover in matchless prose all the wonders of the unknown: the Isle of Mistorak nigh to the River Phison, the valley which some call the Vale Enchanted and some the Vale of Devils and some the Vale Perilous. He may see Ind the More and Ind the Less, the island called Raso where men be hanged as soon as they are sick, the kingdom named Mancy which is the best Kingdom of the World; he may meet Shakespeare's Anthropophagi and men whose heads do grow beneath their shoulders, and learn how Prester John's land lieth foot against foot to England. The translation is an artistic triumph, the old spelling has been wisely retained, and certain passages have been restored from two collated versions of the Cotton MS., which the Elizabethan printers omitted. A delightful book. M. L.

A CRUISING VOYAGE ROUND THE WORLD. By CAPTAIN WOODES ROGERS. With an introduction by G. E. Mainwaring. The Sea-Farers Library. *London: Cassell & Co.* 1928. 9×6 *inches;* xlvi+360 *pages, and illustrations.* 12*s* 6*d*

The voyage of Capt. Woodes Rogers, which is of chief interest as regards the Pacific, belongs to the period between the great age of discoveries and the age of Pacific exploring expeditions. The early eighteenth century was a barren time in Pacific exploration except for the voyages of buccaneers who kept mainly to recognized tracks and were bent on other business than discovery. Rogers was a Dorset sailor who at his own suggestion was dispatched by a number of Bristol merchants for a privateer voyage to the South Seas. The Crown at that time sanctioned privateering for the sake of the injury it inflicted on the enemy, in this case France and Spain, and left the profit to owner and crew. The voyage began in August 1708 and ended in October 1711. There were two ships, the *Duke* and the *Dutchess*, each carrying large crews and numbering thirty and twenty-six guns respectively. William Dampier was on board as "pilot for the South Seas," and the second captain of the *Duke* was Thomas Dover, "a Doctor of Physick," whose seamanship and ability to command men were less to be commended than his inventive skill as expressed in a sudorific powder which bears his name. The voyage led to no discoveries, but it was full of excitement. There were several engagements with enemy ships, including an attack on the treasure galleon from Manila to Acapulco, and a raid on Guayaquil. At Juan Fernandez, where a call was made in order that the sick might have a few weeks of shore life, Alexander Selkirk was found after four years' solitude. Rogers took him on board as mate. There are many other interesting episodes, and Rogers gives several informative chapters on countries that were visited, including the Galapagos Islands, Chili, Peru, Mexico, California and Batavia. Mr. Mainwaring adds a long introduction in which he gives an account of Rogers' life, amplifying the scanty details that were previously available, especially in regard to his later campaign against the pirates who were in the habit of using the Bahamas as a base. The book is reprinted from the original and scarce edition of 1712, and illustrated with several plates, including the chart from the original edition and three prints from the Macpherson collection. It is the first volume in a most promising series on which both publisher and editor deserve congratulation. R. N. R. B.

PHILIPS' NEW SCHOOL ATLAS OF UNIVERSAL HISTORY. By RAMSAY MUIR and GEORGE PHILIP. Tenth edition. *London: George Philip & Son, Ltd.* 1928. 11×9 *inches;* 56 *pages and* 56 *plates.* 5*s*

By the addition to their 'New School Atlas of Modern History' of nine new plates dealing with the period prior to the decline of the Roman Empire, the publishers justify the comprehensiveness of their new title. The remaining plates have also been revised in conjunction with the new edition of their more advanced atlas recently reviewed in the *Journal*. A valuable addition is the map of England according to the Domesday Survey. There is a slight error in the southern termination of the Labrador boundary on plate 51.

BORNEO: THE STEALER OF HEARTS. By OSCAR COOK. The County Library, No. 1, *London: Selwyn & Blount, Ltd.* 1927. 7×5 *inches;* 286 *pages, and illustrations.* 6*s*

OLD CAPE COLONY. By Mrs. A. F. TROTTER. The County Library, No. 2. 320 *pages, and illustrations*

These are two of the early volumes of The County Library Series—reprints of works originally published at considerably higher prices. The texts are unaltered, and each well illustrated and attractively produced. Mr. Cook's account of life in the North Borneo Civil Service, though first published five years ago, should still win many readers. During eight years' service he faced occasional official discouragement, cholera epidemics and riots, as well as the ordinary routine, with sound sense and promptitude, and learnt to love his native charges. His sub-title sums up well his whole regard for the country. To any one, in particular, embarking upon a similar career, this book should be valuable, for Mr. Cook deals even-handedly with the rough and the smooth of the day's work.

Mrs. Trotter's book is older, dating from 1903. Its subject, largely the buildings of the Dutch colonial period, is not one in which this is a disadvantage. The numerous sketches with which it is decked are pleasant in themselves.

BERGWIRTSCHAFTLICHE ARBEITSGEMEINSCHAFT: EINE PROGRAMMSCHRIFT. Von MAX KRAHMANN. *Berlin: Kurt Vowinckel* 1928. 8×5 *inches;* 184 *pages.* *M.*10

Dr. Krahmann, in an appeal published in German, French, and English, points out that at all congresses for the study of economic problems, those of mining are comparatively neglected. He appeals for the formation of an "International Institute of Mining Economics" on the lines of the International Agricultural Institute which has existed with its headquarters at Rome since 1905. The scheme is elaborated in this little book, and in the appendix are reprinted details of the actions taken by the League of Nations on the proposition, as well as particulars of certain comparable proposals. The matter, it appears, is to be considered by the International Geological Congress meeting at Pretoria in 1929, and those interested are invited to communicate with Dr. Krahmann, Technischen Hochschule, Berlin. L. D. S.

THE MONTHLY RECORD

AN OLD ROUTE ACROSS THE AUVERGNE MOUNTAINS

In modern times the main commercial route between Lyons and Bordeaux passes through Clermont-Ferrand, but researches in the local French Archives have enabled Mons. F. Imberdis to show that another and shorter, though more difficult, route was a good deal frequented in early days, though it has now fallen into disuse (*Revue de Géographie Alpine*, Univ. de Grenoble, Tome xvi, 1928, Fasc. 1). It is impossible to say whether it was once the only route in use between the two cities in question, or whether that by Clermont co-existed, being used in winter, while the shorter route was for summer traffic only. In the latter part of the eighteenth century the inhabitants of various places on this shorter route (Marsac, Viverols, etc.) applied for help towards its repair on the ground that it had always been the main line of trade between Lyons and Saint Etienne on the one hand and Upper Auvergne and the districts farther west as far as Bordeaux on the other; being used also for the transport of cattle from the Auvergne fairs to the region of Lyons, Forez, Beaujolais, etc. From the places mentioned as served by the road it must have crossed Auvergne by the Livradois plain, passing south of Issoire, and after traversing the region between Cantal and the Monts Dore, entered Limousin at or near Bart. Mons. Imberdis discusses the question how far the trace of this road was determined by the relief, but shows that the natural conditions were far from advantageous, for it crosses an area much broken by tectonic disturbances, resulting in alternate elevations and depressions which involved rapid ascents and descents. The pass leading to the Livradois—that of Chemintrand—has an altitude of 1000 metres, and the snow in the mountains often lasts for several consecutive months. Its one advantage as compared with that by Clermont (which had certainly come into use by the seventeenth century) would thus be that of directness. It does not seem to be marked on any of the early French road-maps.

SOME PLACE-NAMES IN CENTRAL EUROPE

The *Mineralogical Magazine* for June 1928, vol 21, no. 121, contains some forty pages of very useful information on the place-names of mineral localities in Central Europe, the territory covered being the former Austro-Hungarian Empire, with parts of German and Russian Poland. The places are arranged in parallel columns of (i) the modern national name—Czech, Croat, Polish, etc.; (ii) the old German or Magyar name—sometimes both; (iii) the minerals found. There is a key to pronunciation of the various languages and a glossary of geographical terms. The change of names causes some inconvenience to mineralogists in cases where a mineral has been called after the old name. For example, the mineral nagyagite was named from Nagyág in Transylvania, but this place is now officially called by the Romanians Săcărâmb. The name of the mineral nagyagite must stand: but those who may claim that the place-name Nagyág should also remain unchanged will be interested to read that Baron Born, in his travels in Hungary in 1770, spoke of "Sekeremb, the proper name of the place commonly known under the name of Nagyag." The authors of this valuable compilation are Prof. F. Slavík, PH.D., of Prague, and Dr. L. J. Spencer, F.R.S., of the Natural History Museum.

LIMESTONE CAVERNS OF HERCEGOVINA

A number of caverns in the Karst region of Hercegovina are described by M. Ant. Lazič in the *Bulletin* of the Belgrade Geographical Society (T. 13, 1927), the paper being accompanied by a French *résumé*. These all lie about the Popovo *polje*, traversed by the Trebišnica river. The area includes Površ, a Karst valley of an affluent of the Trebišnica with numerous deep dolines, Šuma,

Poljica or Lug, more flattened by erosion and having many cultivated flat-bottomed dolines from which the region derives its name, and Popovo. During dry periods the Trebišnica disappears about 5 kilometres above Trebinje, but in very wet periods, certain of the dolines are flowing. The Trebišnica then reaches the flat-bottomed *polje* of Popovo, which becomes from October to April a large lake, 20 to 40 metres deep. The water from this lake is absorbed by six groups of caverns, and issues ultimately in temporary springs along the lower Neretva and the Adriatic coast. The most remarkable of these caverns is the Doljašnica, in the cretaceous massif of Hrasno, on the right slope of the Popovo *polje*, the underground passages of which cover 2000 metres. During the existence of the Popovo lake, the Doljašnica galleries are running streams. It has been shown that this cavern is connected with the springs of Svitava in the lower Neretva: during one inundation, water was coloured, and it appeared forty-two hours later at Svitava. Above the Doljašnica caverns there is an extensive depression in the calcareous rocks, in which many natural springs are to be found. Their shafts are characteristically vertical, and were formed by the action of former superficial water. Near the village of Čavaš there are other groups of caverns, which do not, however, approach those of Doljašnica in size or extent.

To the same volume Dr. S. M. Milojevič contributes a study of some caverns in the same district from a hydrographical standpoint. He describes one class which are large-scale syphons from periodic lakes, operating under hydrostatic pressure. The comparative insignificance of the channel development, the existence of one hydrographical level only, and the considerable mechanical action of the water still in progress, show these caverns to be relatively young. Another class described, termed "estarelles," are during the rains sources of small streams, but on their termination the action is reversed, and they become effluents of the *polje*.

THE MAPPING OF ARABIA

We have received the following note from the reviewer of the book on Arabia noticed in the June number of the *Journal*, p. 592 :

" In reviewing ' Ibn Sa'oud of Arabia' I remarked that the author seemed to be justified in his observations as to the inaccuracy of our maps in regard to the Qasim region. In doing so I find that I was overlooking the adjustments appearing in our War Office General Staff Map, 1922, scale 1/1,000,000, corrected to January 1927. I understand that in the preparation of this map the distances variously estimated by recent travellers between particular points in the area in question were carefully checked and adjusted, and it will be found that the distances, as shown therein, between the places referred to by the author at pages 277 and 278 of his book, approach very closely to those which he claims for them.—P. Z. C."

LAKE CHAD

The variations in the level of Lake Chad have frequently been commented upon: Col. Tilho, in the *Annales de Géographie*, May 1928, resumes the discussion on the basis of a series of observations at Bol, on the eastern side, and describes what he considers to be a greater menace to the lake than climatic change. Meteorological observations and a record of the lake-level were kept from November 1912 to September 1919. The latter shows a maximum at the beginning of December and a minimum in the middle of July; the level rises above the annual average two weeks after the autumn equinox, and falls below it about the spring equinox. The low water-level remains practically the same from year to year, but high water-level fluctuates considerably. The curves also

show small irregular variations, probably due to direction of wind or other atmospheric conditions. Col. Tilho distinguishes three " states" for Lake Chad: "petit Tchad," when its area is approximately 12,000 kms.^{2}; "Tchad normal," about 18,000 kms.^{2}; and "grand Tchad," probably 20,000–25,000 kms.^{2}. The lake-level records show that between the small and the normal Chad the difference of level is a metre only: transition from one state to the other can be sudden after one very dry year, or slow and progressive after several dry years, so that it is unnecessary to assume a southern advance of the Sahara to account for the "petit Tchad" of 1904–15. Col. Tilho shows that the level of Chad may be roughly correlated with glacier fluctuations in the Alps.

The shrinkage in the limits of Lake Chad, which seem to have been in progress since the seventeenth century, is ascribed by Tilho to silting by (i) the alluvium of the affluents; apart from the delta of the Shari, this may amount to 3 mm. a year; (ii) the deposits of decayed vegetable and animal organisms, perhaps twice as much as the first; (iii) sand deposited by the winds, varying, from west to east, from 10–75 mm.

Tilho also calculates that local rainfall contributes only 24 per cent. of the rise, the remaining 76 per cent. being contributed by the tributaries, almost entirely by the Shari; and the loss by evaporation, for example in 1908, as only 72 cms. He concludes therefore that the existence of Lake Chad is not threatened from a climatological point of view: what he fears is the capture of the Logone, and ultimately of the Shari, by the Benoue. The mountain belt surrounding the great alluvial plain of the Shari declines at one point on the west from 1200 metres to about 315 metres. This gap is approximately on the same level as the Shari plain—is in fact connected by a marshy depression, the Toubouri, with the banks of the Logone. Fifteen kilometres to the west, however, there is a sudden drop of 50 metres, over which an affluent of the Benoue, the Mayo-Kabi, falls. The south-western tributaries of the Logone, the Barna, Dorga and Kabia, formerly drained the Toubouri depression to the Chad: but the Kabia is now unable to carry its load to the Logone, with the consequence that a large lagoon has formed. In time of flood the overflow from this lagoon runs into the Toubouri, and thence into the Benoue. Added to this is the threat of a further capture on a greater scale: at two points along the Logone water may escape to the Kabia, by the uncompleted Ham-Pogo canal and the natural depression Éré-Pogo. At present, for two months in the year, the latter joins the Logone to the Mayo-Kabi, and it requires only a slight further silting up of the bed of the lower Logone for its waters to be entirely diverted to the Benoue. To guard against this menace to lake Chad, Col. Tilho proposes to clear and keep free the lower course of the Kabia to its junction with the Logone, to prevent the Logone leaving its present course at Éré, and to build a dam across the exit of the Mayo-Kabi from the Toubouri depression. The hydro-electric power which could be obtained here would also contribute to the development of the region, for which Col. Tilho foresees a great future.

WATER SUPPLY IN TANGANYIKA TERRITORY

Although possessing a fairly generous rainfall the region between Tabora (on the Tanganyika railway) and the southern end of the Victoria Nyanza is liable to acute shortage of water in the dry season, owing to the excessive run-off due to its physical character. The population is fairly dense, but the uncertainty of the water-supply has tended to favour migration rather than permanent settlements in agricultural communities. With the advent of European enterprise water is also needed for railways, townships, and industrial undertakings, so that the proper utilization of such water resources as exist is a matter of much importance. The subject is fully discussed by Mr. F. B. Wade in No. 1 of a

series of *Bulletins* inaugurated by the Geological Survey of the Territory (London, Waterlow & Sons, 1927). Granite occupies about 87 per cent. of the area in question, schists being next in importance. Both types are a good deal fissured, but the great age of the granite appears to have caused the joints to be sealed up with clay, etc., and well-sinking in granite country is not recommended, especially as the water-table has here been greatly lowered. The schists are found at lower elevations and seem to yield more water, perhaps because the water-table is nearer the surface. But as these areas tend to be swampy, bush-covered, and more infested with tsetse fly, they are less thickly settled. Of younger formations the principal is laterite, which is of great use as storing water within its bulk on the higher grounds where the natives prefer to live. Sandy soil is found everywhere and yields good crops, and clay occurs in the valleys, forming the "black cotton-soil" where the drainage is slow: this is useless for crops, and the only redeeming point about it is that it acts as a barrier to water seepage. Mr. Wade examines the local conditions at each of the stations (on the railway or otherwise) where water is most needed, and in accordance with them suggests the measures to be adopted for each. The seasonal rainfall must everywhere be looked to as the source of water, and it is thought that shallow supplies derived from it will best repay development. In view of the heavy evaporation underground storage seems the most promising measure, the reservoirs being placed either below the sandy beds of streams or in places where water can be collected by trenches filled with broken stone. Such storage may be expected to counteract the tendency to migration, though for cattle-rearing, reserves of dry-season fodder will also be needed.

LAKE NYASA LEVELS

Some four years ago Dr. F. Dixey, Government Geologist in Nyasaland, discussed in *Nature* the relation of the levels of Lake Nyasa to sun-spot periods, as had been done by Mr. C. E. P. Brooks for Lakes Victoria and Albert (see summary in *Journal*, vol 65, pp. 437–9). It was shown that in general the higher levels corresponded with sun-spot maxima, but that in 1920 a new rise of level began while the decrease in the sun-spot numbers was still in progress, and it was thought likely that the level would go on rising till the next sun-spot maximum, or about 1928. The subject has lately been taken up again by Dr. Dixey in a paper printed in the *Pan-American Geologist* for December 1927, a reprint of which has been received. While dealing once more with the whole question of the variations of recent years, it is of further interest as recording the conditions which have prevailed since 1924. The rise in the lake-level which began in 1920 (due in part no doubt to the entire blocking of the Upper Shire valley, which had made the river quite unnavigable) has in fact, as anticipated, been continuously maintained, with an average yearly amount of 6·15 inches. The rains of 1925 were unusually heavy, and in conjunction with the rise of Nyasa enabled the Shire to cut through the barrier at the head of the Malombe lake, with the result that this lake was re-established after a lapse of many years. The flow of the river was also better maintained; part of the bridge at Liwonde was carried away, as well as several bridges along the Liwonde–Fort Johnston road. The floods played havoc amongst the native gardens, permanent damage being done by the deposit of coarse detritus. Abnormal conditions likewise prevailed during the two succeeding rainy seasons. Dr. Dixey concludes by stating that so far there is no evidence of *progressive* change having occurred within historic time.

THE TSETSE FLY

The importance of the tsetse fly in Central African life has long been recognized by colonial administrators, and many methods of combating its ravages are being tried. This may not yet be so clearly realized generally, so that an article contributed by Dr. W. Frantzen to *Materiaux pour l'étude des calamités*, Jan. 1928, on its geographical distribution and economic significance will be of use. It will also serve as a survey of the available literature, for it is carefully documented. The writer is inclined to take a pessimistic view of his subject, and to be critical of the results obtained by the African administrations. The *Glossina palpalis* is found in Central Africa between 16° N. and 13° S., west of the meridian 35° E.; *Glossina morsitans* is found on the north and east of this area, and extending also farther to the south. The fly is rarely encountered at altitudes over 1200 metres. The *Gl. palpalis* frequents, in general, the fringing woods of rivers and lakes and the deltas and mangrove swamps of the West Coast: the *Gl. morsitans* occurs in the savannah type of country. These are not hard-and-fast distinctions, for there are exceptions, and the whole subject requires further study. The exact extent of the ravages of sleeping sickness is difficult to determine in the absence of continuous accurate censuses: the population of French Equatorial Africa, stated to be 8–9 millions in 1913, had declined to 2·8 millions by 1921, though this decrease obviously cannot be attributed solely to sleeping sickness. A similar loss of two-thirds is recorded in the Kisante district of the Belgian Congo between 1900 and 1910. At the height of the epidemic, between 1901 and 1906, the annual death-rate per thousand on the Buvuma and Sesse islands of Lake Victoria rose to 428 and 133. When it is remembered that, for its development, Africa is under-populated, and that, in addition, human labour has to replace animal transport, the economic effects of this disease will be apparent. The very effect of opening up large areas has often been to spread infection, especially when labour has been concentrated, *e.g.*, for road-making. The efforts to prevent its extension by setting up barriers to intercourse between peoples have directly affected trade, already handicapped by transport difficulties. Similarly, areas from which valuable palm-oil or rubber might be obtained are isolated by the disease, and, but for the fly, an export cattle trade would be possible. On the other hand, economic development, apart from the increased opportunities for contact it produces, has sometimes widened its range. An example is cited where irrigation of banana trees has been responsible for an epidemic. Dr. Frantzen also considers the methods taken to fight this scourge. The difficulty of resettlement on a large scale in an uninfected area lies in adapting the settlers to their new surroundings. This was particularly so when fishing peoples of Lake Victoria were moved away from its infected banks. The value of large concentration camps is also problematical, while the difficulties of wholesale innoculation are obvious. The solution appears to lie in the clearing of the bush and cultivation of wide areas around each village. It is often difficult to secure the destruction of sacred or valuable trees, though the latter may be replaced by economic crops, and small villages find it impossible to keep the undergrowth down. The absence of cattle often means a debased standard of life for the natives, and a declining birth-rate. The problem is to break the vicious circle of disease, hunger and further disease.

ANDAMAN SEA RESEARCHES

Major R. B. Seymour Sewell, Director of the Zoological Survey of India, whose valuable oceanographic researches in Indian waters have already been referred to in the *Journal*, presents the result of investigations upon the temperature and salinity of the coastal water of the Andaman Sea and Bay of

Bengal in the *Memoirs of the Asiatic Society of Bengal*, vol 9, no. 4, 1928. His work on the salinity of the waters of Indian seas has been prosecuted for many years whilst he acted as surgeon-naturalist on the R.I.M.S. *Investigator*, and its accuracy is well substantiated. Perhaps the most interesting result is the discovery of a periodic oscillation in the specific gravity and salinity of the surface water of the Burma coast, the average duration of each wave from apex to apex being 18·13 days. Knowing that in this sea there is a layer of "discontinuity" in density at about 70 fathoms, favourable to the production of an internal seiche, Major Sewell applied Wedderburn's formula for calculating the period of such a seiche in a basin of known length where the density of the water is clearly divided into two layers—an upper of water of low density floating on a deeper layer of denser water. Taking the average density for each month and calculating by Wedderburn's formula the corresponding period of oscillation, the result agrees sufficiently closely with the actually observed period of oscillation in the specific gravity of the surface water to justify the theory of a seiche. It is well known that in lakes seiches are started by winds, and it is thought that the causative agent of this seiche in the Andaman Sea basin is the wind of the north-east monsoon during November and December. This tends to cause an alteration in the depth of the surface water at the two ends of the basin, reaching a maximum effect in January and February. The to-and-fro swing of the water of the deeper level brings more saline water to the surface at intervals of approximately 18 days. There seems, in fact, to be little doubt that in both the Andaman Sea and the Bay of Bengal there is, at least at certain times of the year, a seiche in the more saline deeper stratum whose period in the Andaman Sea is 18 days and in the Bay of Bengal 15·5 days, that of the former being uni-nodal, and of the latter bi-nodal. The periodic rise and fall in the salinity of the surface water also reveals the presence of a bi-nodal seiche of period of 5·3 days *across* the Bay of Bengal (the other being in the long axis of the bay). Superposed upon these major oscillations are a number of minor oscillations which show some relationship with the rise and fall of the tides, but a much clearer one with the double diurnal oscillation of barometric pressure, maximum salinity synchronizing with minimum pressure.

Various other aspects of the subject are dealt with for which the original must be consulted.

HADLEY'S QUADRANT

Mr. J. A. McMichael, a Fellow of the Society, has recently presented a good example of a Hadley's Quadrant to the Society's Museum. The instrument, an important addition to the Collection, is made of wood, and the radius of the arc is 20 inches. It bears the inscription "John Uringa Fecit London," and an interesting feature is that instead of a vernier, the arc has engraved upon it a diagonal scale for increasing the accuracy of the readings. The degrees are divided into 20 minutes, and by means of the diagonal scale it is possible to read to 2 minutes, or even closer by estimation. This kind of instrument was used by mariners about the latter half of the eighteenth century.

The Society previously possessed a Hadley's Quadrant of a somewhat later date, similar in size and general design, but with a vernier for reading the arc. Mr. McMichael's present is especially welcome, as these two interesting instruments can now be shown side by side in the Museum case.

The 1822 edition of Norie's 'Complete Epitome of Practical Navigation' gives a good illustration of the vernier form of a Hadley's Quadrant, with a full description and instructions for use.

WORLD AIR COMMUNICATIONS

A useful summary of the present status of civil and commercial flying in different parts of the world is given in an article by Dr. Hans Pollog in *Weltwirtschaftliches Archiv* for April 1928. The paper contains a mass of statistics relating to the subject, with an attempt to diagnose the causes of the relative forwardness of the various countries in the development of air-routes. A map of Europe shows the nationalities by variously coloured and stippled lines of the air routes in 1927. Germany exhibits a close network of German lines showing the great development in that form of travel which has taken place there of recent years. In England there are no internal routes, but four lines leave London for the Continent, and there is one French line to London. The paucity of French air-lines is attributed to the demands of the army in aircraft, and of British lines to our need of concentrating on the Imperial services. With excellent railways and roads in a relatively small country, and a climate singularly unfavourable to air travel, we have not, it is stated, felt much need for internal aviation. Among the British lines shown we find, of course, that between Cairo and Bagdad and Basra, and French lines include those to Constantinople, Tunis, and Morocco. In Italy internal routes are well developed, and there is an Italian line connecting Skutari, Athens, and Constantinople. Several other European countries control lines, among which may be noted a Spanish route between Barcelona and Lisbon, with a branch from Madrid to Seville.

CORRECTIONS TO THE WIRELESS TIME SIGNALS

The time signals transmitted by Rugby, Bordeaux, Nauen, and Annapolis provide between them practically everything that is wanted by the surveyor in the field, and for many purposes they may be taken as accurate, for their errors rarely exceed a tenth of a second. But when the local observation of time is good enough it is worth while to use the corrections to the transmitted signals. The signals necessarily depend upon extrapolation, and an unexpected change of one-hundredth of a second a day in the rate of the standard clock may accumulate to a tenth of a second if, as sometimes happens in winter, there are no star observations for ten days of cloudy weather. Since the Rugby time signal from Greenwich was established the corrections to that signal, as determined at the Royal Observatory by subsequent interpolation, have been published in Admiralty *Notices to Mariners* issued monthly about a month in arrear : that is to say, the corrections for the month of July will be issued early in September. Similar corrections in a more elaborate form, rather complicated and difficult to follow, have been published several months later in the circulars of the B.I.H. for the above four stations and Saigon. When the Conference of Empire Surveyors visited the Royal Observatory in July last and discussed time signals in the Octagon Room, it was suggested that the *Admiralty Notice* might with advantage include the corrections to Bordeaux, Nauen, and Annapolis as determined at Greenwich, and the Astronomer Royal kindly undertook to consider the question. All surveyors will be grateful to him for his prompt response: *Notice to Mariners No.* 1345, dated 1 September 1928, gives the corrections for the month of July to the Rugby signals at 10h. and 18h., the Annapolis signal at 17h., the Bordeaux rhythmic at 20h., and the Nauen rhythmic at noon. The greatest correction to Rugby during the month was ·04s. and to Bordeaux ·12s., and the averages without regard to sign ·019 and ·039 respectively. The figures for Bordeaux are naturally somewhat greater since they include differences between the time determined at Greenwich and Paris, and the residual uncertainty in the longitude of Paris from Greenwich. The corrections to Annapolis are uniformly positive and their mean ·074s., which agrees pretty well with the statement in the *Admiralty List of*

Wireless Signals that the U.S. Naval Observatory during the year 1925 determined the lag of the Annapolis signal to be about ·09s. If the lag is so well determined it might be better to eliminate it by sending the signal that much early from the observatory. The results for Nauen are a little puzzling. Nauen has for years sent a series of 301 signals covering a period of 4m. 53·1s. Until recently they were said to begin at 12.00.59.4 (*Adm. List* 1927), but in the 1928 List at 12.01.00.3. Both have the statement that the lag of Nauen as determined at Greenwich in 1925 was ·05s. In the example on page 580 of the 1928 List the G.M.T. of signal 0 is given as 12.01.00.32, and this is precisely the mean of the 25 determinations of the first Nauen signal made at Greenwich in July 1928. Surveyors should note that the time of the Nauen signal has been altered, and may wonder why at the same time it has not been made of the standard pattern.

NORSE SETTLEMENTS IN GREENLAND

The history of the early Norse settlements in Greenland has not yet been fully unravelled, and it is only through careful archæological research on the early sites that fresh light on the subject can be expected. In the *Journal* for May 1926 (p. 474) reference was made to work of the kind undertaken by Dr. P. Nörlund, and a short summary of his results was given, based on a detailed account in vol 67 of the *Meddelelser om Grønland*. Dr. Nörlund returned to continue his investigations in 1926, and on the basis of the whole results obtained has given a general view of the question in the Danish *Geografisk Tidsskrift* for March 1928. An English summary there supplied will be useful to those to whom the Danish language presents difficulties. All the finds must date from the interval 1000–1500 A.D., most of the dwelling-houses belonging probably to the latter part of the period. In his two visits Dr. Nörlund explored two of the most remarkable sites—Herjolfsnes (now Ikigait) and Gardar (now Igaliko), the first having been the port of call of the traders, the second the residence of the Bishop and the chief centre of the Norse settlement. The excavations have given a surprisingly rich picture of mediæval life in Greenland. The Bishop's residence can hardly have been inferior to those in Iceland, and was equally manorial in character, being remarkably well stocked with cattle. The settlers did not depend for their daily food on supplies from Europe, though these added something to the amenities of life. Gradually, however, the voyages from Europe became less frequent, partly perhaps because of the decadence at home during the fourteenth and fifteenth centuries, and partly because such voyages became less lucrative. The life of isolation they led caused also a progressive physical degeneration of the inhabitants.

MONUMENT TO JOSEPH PETIGAX

Mr. Freshfield has received from H.R.H. the Duke of the Abruzzi the following telegram acknowledging the subscription sent by the Council on behalf of the Society to the monument erected at Courmayeur to the memory of the guide Joseph Petigax, who was the companion of the Duke in his expeditions to the Himalaya, Alaska, Ruwenzori, and the Arctic.

"Courmayeur, August 30th. On the occasion of the celebration to honour Guide Petigax I desire to thank you for your kind participation and generous contribution. Best regards.—LUGI DI SAVOYA."

OBITUARY

Captain ROALD AMUNDSEN

Since the Latham seaplane piloted by Captain Guilbaud set forth under the orders of the French Government from Tromsö on June 18 to the rescue of the *Italia's* survivors, and took with her Captain Amundsen and his old comrade in polar adventure, Lieutenant Dietrichsen, no word has been heard from them. But the mute witness of a damaged float picked up off the Lofoten islands late in August makes it all too probable that some accident brought them down in the sea not long after the start. One would like to believe that some combination of skill and good fortune, such as he had the secret to command, may have preserved Amundsen and his companions; but as time passes the belief is difficult. Without finally presuming his death, it is proper to give now some account, inadequate though it must be, of his remarkable life as an explorer; and to assure his countrymen that, though he unhappily came himself to doubt it, his great qualities and outstanding achievements were as fully recognized in England as in any country of the world. He was the first and only man to take a ship through the North-West Passage; he was the first to lead a party to the South Pole; only one ship before his had made the North-East Passage; and he, joint leader with Mr. Lincoln Ellsworth, made the first flight across the north-polar basin. For the North-West Passage he received the Gold Medal of our Society, and on his return from the South Pole he was cordially received and warmly congratulated in words which have recently been reprinted in the *Journal*. No one regretted more deeply than his English admirers that a recollection of this meeting, and what they are sincerely convinced was a mistaken recollection, should have led to Amundsen's resignation from our Honorary Corresponding Membership.

The materials for a sketch of his life can be found in his last book: ' My Life as an Explorer,' and those who may remember only that this book contains some controversial matter will do well to read it again for its interesting account of how he of set purpose trained himself for the life of exploration on which he resolved when he read the story of one of Sir John Franklin's journeys. He was born near Oslo and brought up in that city, intended by his mother, but not by himself, for the medical profession. Having made his resolve at the age of fifteen he took vigorously to football, which he disliked, and to ski-running, in which he was an enthusiast. As a first taste of the explorer's joys he essayed with one companion the crossing of a high plateau north of Oslo in winter, and barely escaped with his life. Being convinced that divided counsels had ruined previous polar voyages, he resolved that he would fit himself to be the captain of the ship as well as the commander of the expedition, so he signed on as seaman on a sailing ship during the summers of 1894 to 1896, and in the following year, when 25, was made first mate of the *Belgica*, which sailed for the Antarctic under the command of Commandant de Gerlache de Gomery. The ship had her full share of adventure and difficulty; it was an arduous but fruitful training for the young enthusiast. Returning safe from the Antarctic in 1899 he obtained his master's certificate in 1900, studied magnetism at Hamburg under von Neumayer, and bought the famous *Gjoa* of 47 tons, which he took out in 1901 for a season's oceanographical work in the North Atlantic between Norway and Greenland, in preparation for his project to locate the north magnetic pole and make the North-West Passage.

The circumstances of his departure in 1903, as he tells them in his book, have all the characteristics of impulse that distinguished him to the last. Arriving after a successful voyage in favourable conditions at the southern end of King William's Island, he built a magnetic observatory of the packing cases carefully

prepared with copper nails, and there he spent two years observing the magnetic elements and making collections of Eskimo implements. Getting free on 13 August 1905, he sighted a San Francisco whaler on the 26th and felt that his success was assured, but was again beset near Herschel Island on September 2 and forced to prepare for a third winter in the ice. Unwilling to spend this winter inactive, he took a dog team and travelled many hundreds of miles to the nearest telegraph office to report progress, returning to the *Gjoa* in the spring, and reaching San Francisco only in October 1906.

After a winter spent in a way sadly familiar to Polar explorers, lecturing to pay off the debts of the expedition, Captain Amundsen secured Nansen's old ship the *Fram*, and began to provision her for a North Polar drift, which was to enter the ice farther east than Nansen did, in the hope that the drift would take him more nearly across the Pole. The preparations for this enterprise filled the two following years. Meanwhile Peary reached the Pole in April 1909. When, therefore, Amundsen sailed in August 1910 ostensibly for Bering Strait and his North Polar drift, he had secretly in mind a bold diversion from his acknowledged programme. Calling at Madeira he left there a sealed envelope containing a telegram to be dispatched to Captain Scott within a few days, announcing his intention of making an attempt at the South Pole. This telegram Scott never received, and the first news that there was a rival in the field came to him on the return of the *Nimrod* from her cruise along the Barrier and her quite unexpected discovery of the *Fram* lying in the Bay of Whales at the place which Amundsen had chosen for his base. This bold choice of a base on the Barrier was the foundation of Amundsen's success. It had been considered by others and rejected as too dangerous. But Amundsen by careful study of past records had convinced himself that the Barrier at the Bay of Whales was aground and had not altered in its outline practically at all since it was first mapped. The story of his smooth and triumphant progress need not be retold, but it is well worth the while of any future explorers who propose to work with dogs to study in detail the chapter towards the end of Amundsen's last book in which he sets out the arguments for dog transport and the careful way in which he made a programme that was absolutely justified by the event. He and his companions had the great advantage that they thoroughly understood the use of dog teams and that they were all experts on ski. After laying three depôts in the autumn on their arrival, they spent the winter reconstructing all their gear on the experience of the depôt-laying journeys, and it is interesting to read in detail how they tried to save weight and to remodel their clothing. They reached the South Pole in December 1911, and their return journey, favoured to some extent by good weather and supported by the elation of success, went as smoothly as the southward journey. When in 1912 they returned to Europe they could point with justifiable pride to an enterprise which had been successful in every way because of its careful preparation based on sound consideration, and personal skill in the essentials of rapid sledging. The success and the fate of Scott and his companions were still unknown, and though there was natural disappointment in England that the prize had been snatched from Scott by a daring coup, there was ungrudging applause for the victors.

Captain Amundsen had now to take up again the project which he had so dramatically varied, and satisfy the obligations which he had incurred to his supporters who had backed the North Polar drift. In 1914 he began to refit the *Fram* and bought a Farman biplane, but the outbreak of war made it impossible to continue for the time being, and he tells how with many others of his countrymen he took advantage of the profitable opportunities open to neutral shipping, and in two years made what he considered a sufficient fortune to justify him in

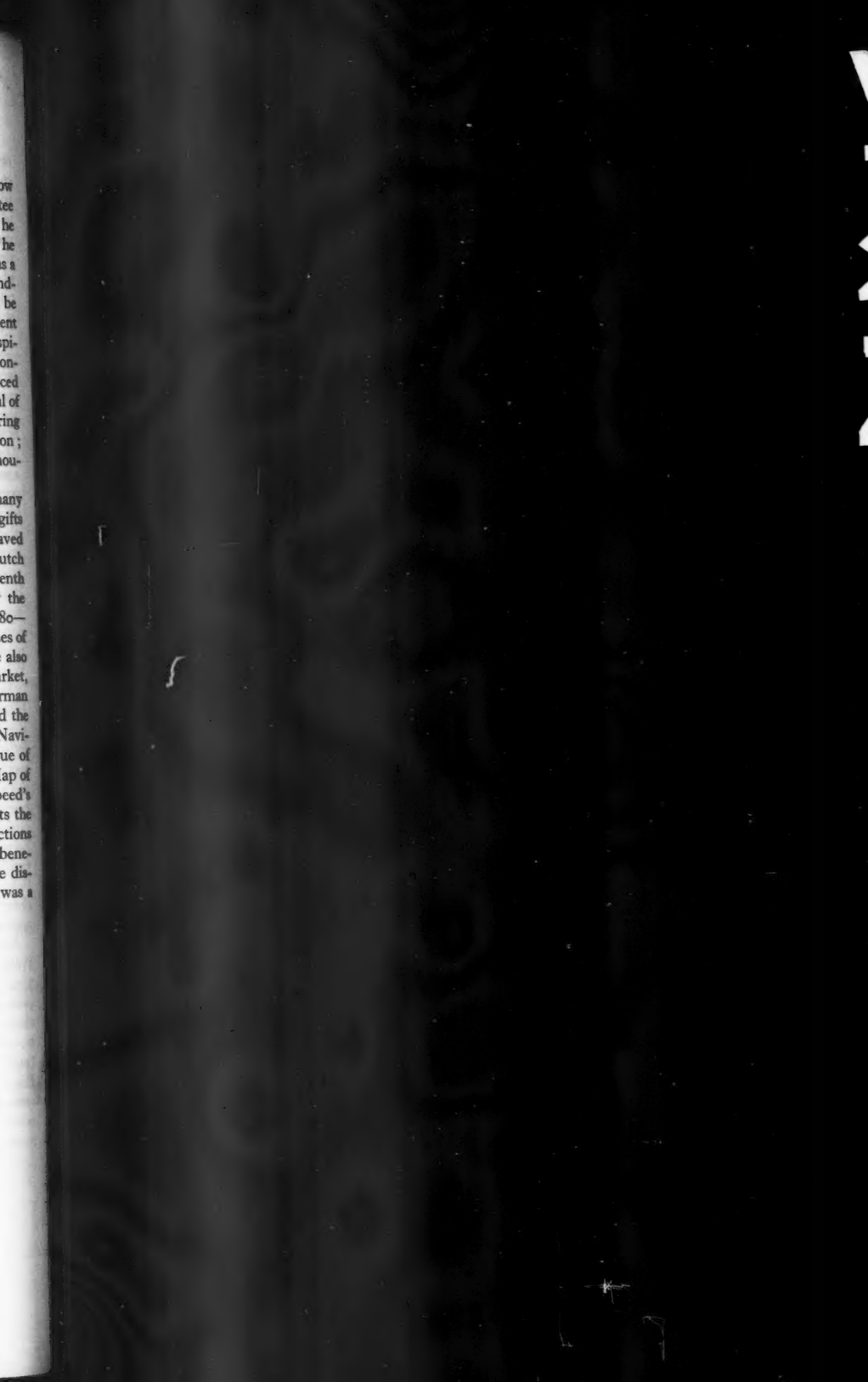
retiring from that business and looking once more to the north. By that time the condition of the *Fram* was unsatisfactory, and he resolved to build a new vessel without, as he admits, reckoning upon the vastly increased cost of construction, which consumed more than he had allowed for of his fortune. But he went on unflinchingly, and the *Maud* was launched in 1917. The perils of submarine warfare at its crisis delayed the start until July 1918, when he took advantage of a report that the German submarines operating in the Arctic had temporarily returned to their bases, and he started on the North-East Passage, being beset at Cape Chelyuskin on September 18.

They were not free from the ice until September 1919, and after some progress eastward were again beset at Aion Island on September 23. Here they remained until July of 1920, when they completed the North-East Passage and put into Nome to refit. Starting out from Nome in the autumn with a diminished ship's company, they suffered a mishap to the ship and were compelled to winter at Cape Serdze, Anadyr, returning to Seattle in the spring of 1921 to refit the *Maud* while Amundsen went back to Norway to raise further funds, and received a grant of half a million kroner from his Government. He then bought a Junker aeroplane with the intention of attempting a trans-Arctic flight. Leaving Seattle on June 1 he transferred to another ship with his mechanic Omdal and the aeroplane, while the *Maud* under the command of Captain Wisting tried to find a favourable position for beginning the drift. The following years were unpropitious. While the *Maud* never succeeded in getting herself into a promising Polar current, Amundsen suffered a series of misfortunes, first by damage of his aeroplane, and later in the financial stringency that attends inevitably such expensive ventures: difficulties that were not solved until he had the good fortune to meet Mr. Lincoln Ellsworth in 1924, who was eager to support a flight to the Pole from a different base.

While the *Maud* was still unsuccessfully battling with the ice the Amundsen-Ellsworth Expedition arrived at King's Bay in 1925, and on May 21 started for the Pole with two Dornier-Wal flying boats. Their boats descended in latitude 87° 43′, and the sensational reappearance of the party in one machine after three weeks' struggle to make a run-way are facts fresh in our minds. Already before the start Amundsen says that he had talked of an airship. No sooner had he returned than he and Mr. Ellsworth bought from the Italian Government the small airship constructed by Colonel Nobile, in which they flew in 1926 from Spitsbergen to Point Barrow, crossing the North Pole and seeing no land in the Beaufort Sea. The flight demonstrated the possibility of an airship route across the Pole; and if the dangerous troubles of the last 1000 miles dimmed to a serious observer the splendour of the beginning, any such doubts were lost in the general applause.

Amundsen had now a record unique in Polar exploration: he had made both Polar passages, and visited both Poles. He might without hesitation have left to younger men the duty of responding to a call for volunteers when the precarious position of General Nobile and the other survivors of the "Italia's" crash demanded immediate efforts at rescue. Putting aside any recollection of the controversy which had arisen since the Polar flight, he embarked with Captain Guilbaud in the seaplane sent by the French Government, and his fate is unknown. His last generous impulse secures for him a high place in the regard of all, and crowns the reputation which he had made for himself in a life of Polar endeavour as the most intrepid and unflinching, the most practically accomplished and successful, and the most versatile explorer that this century has seen.

Mr. HENRY YATES THOMPSON

Mr. Yates Thompson, who died on July 8 at the age of 89, had been a Fellow of the Society for 59 years : for many years a Member of Council, and a Trustee from 1914 to 1924, when he resigned owing to advancing infirmity. All that he was willing to have said in the pages of a famous book of reference was that he was at one time proprietor of the *Pall Mall Gazette*. The Society knew him as a famous collector of manuscripts and rare books, generous to the Library, a handsome contributor to Lord Curzon's Building Fund, and a friend who could be relied upon to assist whatever was proposed for the Society's benefit : an ardent Harrovian, a classical scholar of Trinity, Cambridge, a man of unbounded hospitality in Portman Square and at Oving : a liberal in politics, and strong conservative in his mode of life. When his sight failed some years ago he announced the sale of his manuscripts, and characteristically began by presenting several of the best to Museums and Libraries. He was keen to insist that mountaineering interested him not at all, before subscribing to the Mount Everest Expedition ; and with a like spirit of paradox he entertained his many friends and did a thousand kindly and generous actions.

The Society has been indebted to Mr. Yates Thompson's liberality for many valuable additions to its Library and Map room. As was natural, these gifts reflected his personal tastes in the direction of finely illustrated or engraved works of early times, and included many of the artistic productions of the Dutch or Flemish School of cartographers of the late sixteenth and early seventeenth centuries. Both the copies of Saxton's County Atlas now possessed by the Society—the first edition of 1579 and the first issue by Philip Lea about 1680—came from his own Library, as did also various editions of the General Atlases of Ortelius and Mercator, including the first complete issue of the latter. He also came to the Society's aid on several occasions when rarities were in the market, and in this way it secured the scarce Early English sea-book of Robert Norman called the ' Safeguarde of Saylers, or Great Rutter ' (edition of 1590) and the issue by Joseph Moxon in 1657 of Edward Wright's ' Certaine Errors in Navigation,' a book almost if not quite as difficult to meet with as the first issue of 1599. He also contributed substantially to the cost of the unique World-Map of Hondius the elder, purchased in 1919, and to that of two editions of Speed's English Atlas acquired only two years ago. And this by no means exhausts the list of gifts, by which previously existing serious gaps in the Society's Collections have been filled during the past quarter of a century. Apart from such benefactions, his knowledge and judgment in such matters were always at the disposal of the Library and Map Committee during the years in which he was a valued member.